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ABSTRACT

An American Society for Engineering Education team, made up of experts in engineering, agriculture, business, and health, establishes in this study a factual and philosophical base for measuring and meeting the need for midlevel technicians in Central America. The controlling assumption of the study, based on the experience of fully developed countries, is that properly trained technicians are increasingly crucial to progress in agriculture, business, engineering, and health as economic development accelerates. Arranged by these occupational areas, sections describe the status of each occupation and the educational preparation it requires, summarize recommendations for the development of midlevel technicians, and discuss implementation strategies for educational improvement. Recommendations that are offered for immediate action in health, for instance, include finance for renovating, equipping, and expanding present health care facilities; higher salaries for health team members; development of more and better qualified lower health personnel; and improved health service programs in the areas of nutrition, sanitation, potable water, and family planning. Appendixes include bibliographies, statistical charts and tables, and lists pertaining to the subject matter in this study on Latin America. (Author/DE)

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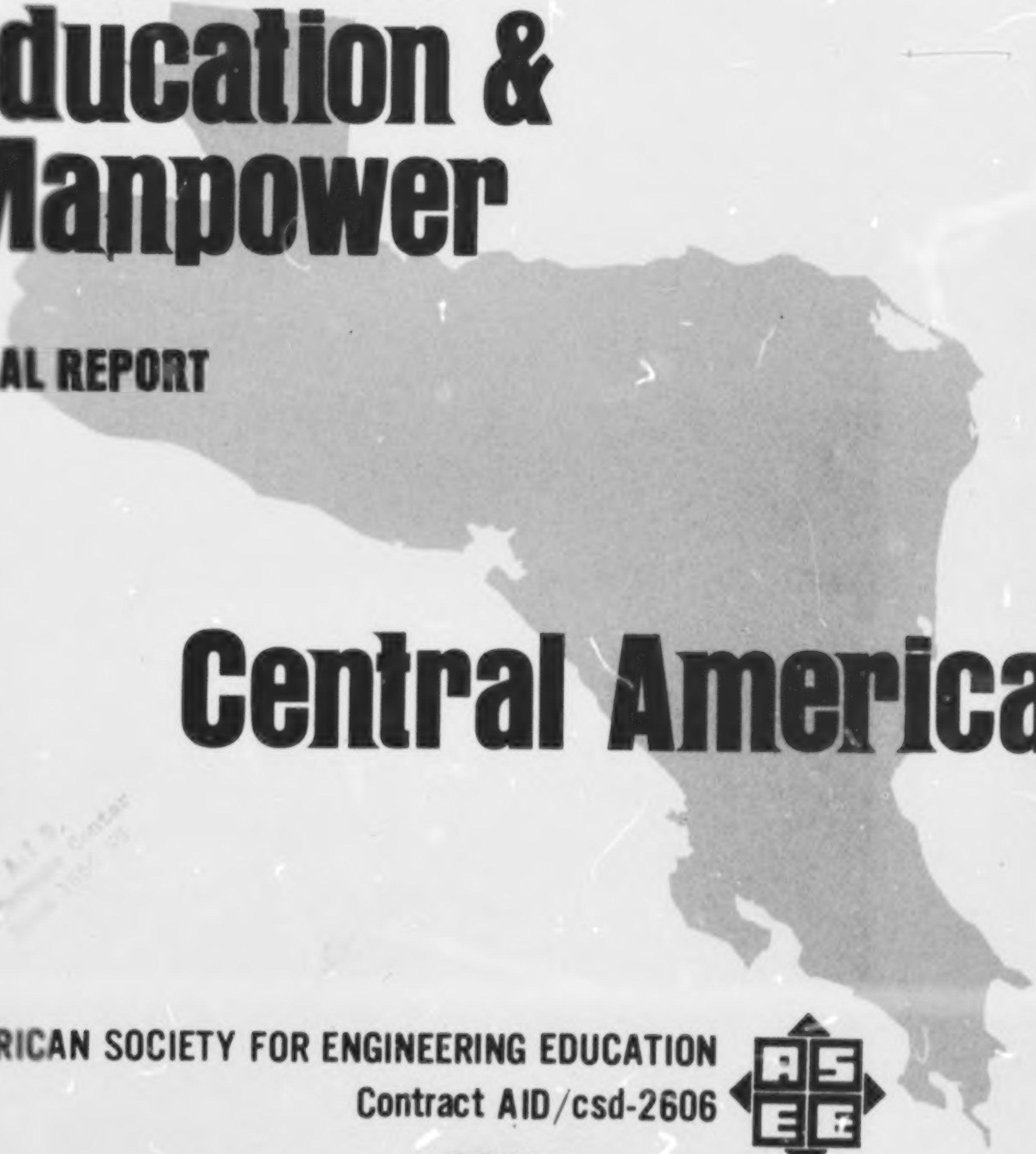
Mid-Level Technical Education & Manpower

FINAL REPORT



Central America

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AMERICAN SOCIETY FOR ENGINEERING EDUCATION
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FOREWORD

This study aims to establish a factual and philosophical base for measuring and meeting the need for mid-level technicians in Central America. A controlling assumption based on the experience of fully developed countries is that properly trained technicians are increasingly crucial to progress in agriculture, business, engineering and health as economic development accelerates. Creation of technical manpower at this level opens up new opportunities for the citizens of Central America to contribute, through a dignified, professional type occupation, to the economic and social well-being not only of their country but also of Latin America and the world community.

Our study is sensitively aware of the national priorities called for by orderly development. Among them agriculture surely ranks high for its contribution through adequate nutrition to the physical energy of the people and through the economic benefits of the trade of surplus commodities in world markets. Closely coupled with agriculture is health care. Beyond sheer survival, health and happiness move people to creative productivity.

Both health and agriculture, however, need the undergirding of a strong industrial and business economy to generate the disposable national income upon which they depend. Logically, therefore, the emphasis must be on the whole social and economic system moving ahead together.

We sincerely hope the thoughts and recommendations presented in this report faithfully reflect the spirit and substance of what we learned from the many well-informed leaders from government, agriculture, health, industry and education whom we consulted. Without their patient and sensitive responses in the course of hundreds of visits to Central American establishments, we would have been lost. We came away fully convinced that the talented and dedicated Central Americans we met were fully capable of carrying out future developments related to mid-level technical talent which would be in the best interests of all concerned.

The members of the team also came away with feelings of sincere gratitude for the patient understanding and willing assistance of the personnel of AID in Central America.

Finally, we also want to acknowledge the advice and support of Luke M. Hale, Deputy Director of Engineering (AID), of Hugh E. McCallick and his associates on the ASEE advisory committee; also, the administrative assistance of F. X. Bradley, Jr., Director, Projects and Federal Relations and his assistants on the ASEE headquarters staff.

Harold P. Skamser
Chief of Field Party

THE ADVISORY BOARD

The American Society for Engineering Education brings the talents of engineering educators and others to activities designed to improve and foster the education of engineers in all its ramifications from student recruitment to the continuing professional development of graduate engineers. In pursuing this goal, the Society tries to be responsive to the needs of its several constituencies, the engineering colleges, technical institutes, junior and community colleges, industry, government and international engineering education. Also, to insure maximum involvement of its members, the Society seeks to realize this goal through councils, divisions, sections and committees formed from among its 14,000 individual and institutional members.

As a matter of policy, the Society entrusts to one of these organizational units or to a specially appointed committee the responsibility for seeing that its obligations under sponsored grants and contracts are properly discharged. Thus, it is that an advisory committee, the members of which are noted in Appendix of this report, was appointed for this AID sponsored project to study the status and future of middle level education of technicians in agriculture, business, engineering and health in Central America.

The members of the committee, together and singly, have met with officers of the International Division of ASEE, officials of AID, the field team and members of the ASEE Headquarters staff. The conduct of the project by the field team followed a pattern reflecting recommendations from all these sources.

The members of the advisory board recognize the constraints both in time and money which ultimately affected what the team was able to accomplish. Within these constraints, the team worked intensively and effectively and generated information and recommendations which should be of help to the responsible officials of Central America. The advisory role of the board did not extent to modifying in any way the substantive content of the reports of the team members. The recommendations and findings of this report are attributable exclusively to the members of the team and should not be construed as coming jointly from both the team and the advisory board.

The members of the advisory board are grateful to the team members for giving up on short notice and at considerable personal inconvenience their other plans for the summer of 1970 to serve ASEE, AID and our friends in Central America through the conduct of this study. Working with these five men representing four different professions each with its own inner dynamism and scholarly outlook was a stimulating experience for all of us.

Hugh E. McCallick
Chairman, Advisory Board

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INTRODUCTION

Central America is following the classical pattern of Western nations in its social and economic development. This pattern becomes progressively more intricate as the variety and scope of social and economic institutions increase. Concomitantly, the dependence of this developing community on increasingly diverse and sophisticated technical skills is creating an enhanced awareness among Central America's leaders of the need for technicians trained at a level between the vocational and the professional. The rapid growth of trade among these countries in the last decade and the emphasis on larger, more complex and sophisticated regional business and manufacturing organizations is placing an increased demand on technical education. Technicians are seen as needed to support and augment the work of engineers, doctors, agricultural scientists and managers of business and public services.

In the course of this study a team organized by the American Society for Engineering Education (ASEE)(1) at the request of the U.S. Agency for International Development (AID), met with the leaders in government, industry and education in Central America. They almost universally expressed their conviction of the further need for well educated, competent middle level technical and supervisory manpower. To discern the full dimension of these needs and to recommend courses of action to meet them, the ASEE team(2) made up of experts in engineering, agriculture, business and health technologies visited Central American educational institutions, government agencies, health and agricultural facilities, business and industrial organizations.(3) The team had adopted as a first principle that existing institutions with their capable and dedicated people would be looked to first as the potential national resource for meeting the needs for mid-level technicians.

The content, analysis and recommendations of this study reflect the knowledge, wisdom, judgment and experience of the national leaders.

The promise of meeting the needs identified in this study is greatly enhanced by the foresight of Central America's leaders in developing long-range, comprehensive plans for progressively upgrading the level of general education in the country. In particular, the National Planning Councils and the newly developing councils for the development of human resources (as in Costa Rica and Panama) bode well for the future.

Central Americans are aware that the key to their pressing socio-economic problem is the development of human resources through an improved educational system. Despite the rapid growth in capacity at all levels of the education system, current capacity and quality is insufficient. The traditional approach is giving way rather slowly to new concepts. As yet progress has been insufficient in the following critical areas:

1. Reduction of very high drop-out rates.
2. Modernization in content and method of teaching.
3. Adult education.
4. Setting of educational priorities and more effective use of limited existing resources allocated to education.

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[1] See Appendix L for description of ASEE.

[2] See Appendix I for narrative of study.

[3] See Appendix J for partial list of persons and organizations visited.

The conclusion of this report is that the fundamental process of modernization of society and the economic progress is closely related to the quantity and quality of output of the educational system. As the first step, priorities must be established to overcome deficiencies in education which are critical to the development process. We see a need to emphasize intermediate technician level training to avoid the strangulation of the development process. Current policies are likely to produce an oversupply of professionals in occupations which have high status but few employment opportunities. A recent evaluation of development efforts in Central America by a distinguished group came to this similar conclusion:

> Our main conclusion is that there has been no attempt made in Central America to establish a program to train technicians, executives and administrators to overcome the present strangulation effect (on economic activity), and to strengthen the capacity to absorb outside resources.(4)

Need

The statistical sections of the Appendices(5) illustrate the strong population, educational and economic growth trends which necessitate more, adequately trained, manpower at the middle technical levels. Strong economic growth can also increase resources available for further development of technical education.

Statements of Leading Central Americans Regarding the Need for Technicians

It is quite clear that the business, health, and industrial and agricultural worlds of Central America have progressed as far as they have with an extremely limited number of technicians in these four fields. At present they are managing pretty well without any appreciable number of trained technicians. But, if one listens to many of the leaders, or looks toward a future continuation of the present economic growth rate, the long range picture is another matter. There is no need (surely) for programs in each country which will produce hundreds of graduates in each specialized area. But there is, generally speaking, a strongly felt need for a growing number of technologically trained people at the mid-level.

In El Salvador one of the leading industrialist-businessmen(6) said in an interview, speaking of higher level technician needs: "El Salvador must train existing working people and students coming up. But first you must motivate people (the community). Identify the level, the field and interested people. Give it status. It has none now. People confuse it with the plumber, brick mason, etc. It leads to middle management. Permit preparation without the *Bachillerato*. Keep the door open so the man could go on to the University. Have a mixed Board of Directors (for schools) of Business and Industry men which is almost autonomous."

In Costa Rica there is a strong movement for a law to establish a National Technical Institute. An institution patterned after the Monterey Technical Institute is part of the national planning. This might become a regional school.

In Guatemala there have been many moves to develop programs for training technicians. The University of Landivar wants to start three such programs initially. In 1968, the University of San

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[4] Evaluation made by CEPAL and the Committee of Economic Cooperation of Central America Isthmus in 1966. (Quoted in ODECA-OCEPLAN Study 1970).

[5] See Appendix D, Appendix G and Appendix H.

[6] Francisco De Sola

Carlos proposed, as part of its academic plan for 1974, broad programs in many fields at the technician level.[7]

The General Manager[8] of the Camara De Industria said, "All the industries who are members always tell us we need some people in the center between the manager and the workers. The University del Valle will be most important in technical areas," he said. "They are very interested, and are emphasizing this."

A leading industrialist-businessman[9] said that the most important needs of Guatemala (speaking of education) are construction, textile and maintenance, mechanical, and electrical technicians (in order of priority).

In Honduras the National University has two technician programs. The planners for the University say "Middle level technicians are urgently needed in a broad spectrum of areas (based on what will be needed in the future). The planners are thinking about more two year programs at the University." The manager of the Association of Chambers of Commerce says, "If one should be funded, (technical institute) it would be best placed in San Pedro Sula. This would be the best thing that could happen to this country."

In Nicaragua a representative of the Camara de Commercio, Industria, Y de Construccion[10] said, "We need technical manpower, we need to establish new industries and organize all the industries to produce more efficiently." Also, the Minister of Labor said, "We need at least one technical level (middle) institution for each country." He doesn't think that very many students would go to other countries to regional schools.

Also in Nicaragua, Ing. Fernando Sequiera of the Banco Central de Nicaragua (their Federal Reserve) who is involved with development, said, "The management level is a very low level. We need people at the middle level. It is large, there is a very great need. There is a tremendous need for it. We are not producing this kind of people here. Local managers are beginning to see the need for middle level technical people. (INCAE is somewhat responsible for this). Nicaragua has no one to carry out the instructions of top management. Present employees do not have the capabilities and know how."

While this was the general trend of comments by people we interviewed, perhaps we are more conservative and reserved because of our thought that perhaps we were hearing what we wanted to hear. However the real question seems only to be when, where and how much. It is recommended that a conservative approach be taken in developing new programs and schools, and that these should meet only sound demonstrations of needs, and preferably be based on National Manpower studies.

Not many employers realize that mid-level technical institute graduates are well educated to perform in a wide variety of responsible posts: as specialists, as supervisors, as first level and middle management and as community leaders especially in agriculture and health. There have been so few technicians that the employers have not learned what a technician really is and what he can do. For instance, smaller businesses which cannot afford an engineer do not consider hiring a technician and backing him up with consulting by an engineer when necessary.

In the major cities of Central America a great eagerness for further practical education is exemplified by the many thousands of students attending upstairs night schools in the business districts. The education and training of an adequate number of craftsmen and artisans generally seems pretty well assured.

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[7] See Appendix N.

[8] Carlos Enrique Rivera

[9] Dr. Imrich Fischman

[10] Edgar J. Sevilla R.

Students for technical institutes will come, primarily, from among high school graduates and people working in the particular specialty area, but will also include some transfer students from university programs. The high school graduates' pool of potential students is a large one. In every country many thousands of high school graduates in each graduating class are not able to attend the established universities. The current programs for the establishment of vocational comprehensive high schools is bound to be a great stimulus to technical education.

A. Recommended Characteristics of Technical Education in Central America

1. *Integration of technical education into the national systems of education* is essential for long-range success.

2. Along with integration into the national plans, these technical institutes, as broadly defined above, must have the *independence to select their faculties, determine their curricula and control their finances.* Dependence upon existing universities would generally result in severe danger of diluting the strength and limited assets of present university programs. There is also the danger of technical programs becoming second class (due to their unique difference) and of losing their support (equipment, space and finances) to more prestigious programs in the universities.

3. *The technical institutes need to develop their own faculties*, predominantly staffed by well-paid, full-time instructors owing primary allegiance to the program of the institute rather than to that of the university. Faculty members in universities are usually psychologically attuned to theory and philosophical considerations. They are not likely to function well in a milieu where practical experience and applied learning combine to prepare young people for productive employment as middle level technicians.

4. *Technical institutes should share academic, commercial, industrial and government facilities.* Collaborative arrangements can get expanded technician training programs going without waiting for the construction of classrooms and the equipping of laboratories. Student technicians are readily accommodated in cooperative education arrangements with prospective employers.

B. Recommended Actions for Development of Middle Level Technical Education

1. To gain public acceptance of the technician as a man of significant social value, an informational (marketing) approach for students, employers, the government, and the public is essential. The image, prestige, and general acceptance of the technician must be a major part of any plan or action for educating technicians. New titles which have a positive image must be adopted, used, promulgated and accepted.(11) There needs to be full government recognition for both the technical institutes and their graduates. The typical national attitudes need to be changed in order for the general acceptance of technological careers to become a reality.

2. Studies of the current and projected manpower needs for middle level technicians in business, industry, government, education and health, both private and public, are urgently needed if informed decisions are to be made about specifics of a national program to educate middle level technicians.

3. Profession and business oriented advisory committees should be formed at both the national and local institutional level. They are effective in making educational and training programs responsive to the needs of prospective employers. They also provide important links with community sources of cooperation and support.

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[11] See sample diplomas and titles awarded by the Institute Politechnico de Nicaragua, and signed by the President of the Republic, in Appendix M.

4. Educators must control the work experience part of technical higher education to make sure that it is truly educational and in the best long-range interest of the country, the students, and employers. They must not allow cooperative education of technicians to be exploited by employers as a source of low-cost labor. A national employment service and placement staff in the technical institutes appear to be essential to establishment of successful programs and careers.

5. Whatever the institutional setting, careful coordination of laboratory and lecture instruction with relevant work experience is needed to produce competent graduates. *Typically*, these graduates will have two years of education beyond the secondary school. They will have gained the technical knowledge and skills to support and augment the work of professionals in agriculture, business, engineering or health. In the Western World it is fairly well agreed that, to most effectively use the professional talent available, two or more such aides should be provided for each practicing professional.

C. Recommended Characteristics of Faculty for the Education of Mid-Level Technicians

1. Faculty development is a long lead time prerequisite to providing worthwhile technical education. Actions to develop faculty must be taken systematically and promptly. (ODECA is said to be interested in regional teacher training centers for faculty in some fields).

2. Faculty members need to be educated up to contemporary standards. They need to be imbued with dedication to technical education at this level, and its philosophy. They must have the potential to grow with the system.

3. Both faculty and students should be engaged full-time. Part-time faculty members and students are too distracted by other concerns to do justice to their educational roles. The savings, in time (years) and resources could be very large.

4. Both faculty and students need related work experience to give relevance to their scholarly life. (For faculty members, experience prior to assuming teaching duties is essential).

5. Faculty members should have access to updating study and work experience, in-service academic training, and to the published learning pertinent to their interests.

6. Faculty members should be involved in creating the curriculum so that they can feel a part of the on-going educational process. Separate staff may well be needed to develop teaching materials to allow other faculty members to do a top notch job by concentrating on teaching. This is most needed for new programs and institutions.

7. Teacher preparation could be most rapidly accomplished initially by sending prospective or current teachers to other countries where further education at strong, successful technical institutes is available, and by having highly capable faculty from these kinds of institutions to work closely with counterparts in Central America.

D. Recommended Priorities in Education for Mid-Level Technicians

1. Accumulate and keep current data on manpower needs of government, industry, science, engineering, health and agriculture.

2. Develop new curricula or revise old continually to meet the needs revealed by the manpower study.

3. Retain established faculty members and attract new ones to perform effectively in the evolving curricula.

4. Adapt existing facilities, share facilities with other institutions or with industry, and build new facilities to accommodate the requirements of the courses of study and of the teachers.

5. Bring word of the need for mid-level technicians to all the people in a position to respond, particularly the post secondary school students with interest and aptitude.

6. Perfect the organizational structure for administering this level of education.

7. Develop counseling and placement activities.

8. Engage government, business, industry, the health professions and services, science and engineering in a continuing planning, programming and budgeting operation to insure the long-range viability of a system of mid-level technical education.

RECOMMENDATIONS FOR REGIONAL TECHNICAL INSTITUTIONS

There are at present in the five Central American countries ten regional programs. These range from relatively short programs through technician programs, to Bachelor's and Master's degree levels.(12)

Since the practice is already well established and very successful in more than one country perhaps it would be well to consider the possibilities for further regional educational opportunities through opening the opportunities in established schools to neighboring countries, or by strengthening new or well established schools for international service, or even the development of new institutions initiated primarily for international service to all of Central America.

One of the early steps should be a more thorough study of the needs, perhaps through national manpower studies so that programs can be based on how each country sees its own needs. The pattern suggested in the health portion of this report might well be used for business, agriculture, and engineering. However, agriculture already has established technical institutions in each country, and a strong regional school.

Regional health programs in Costa Rica, El Salvador, Nicaragua, Guatemala, etc., for very specific fields (see health report) are possibilities. Adding business, or health, or other fields to existing programs has many advantages in terms of efficiency and effectiveness.

Since practicality, needs, human and other resources would not justify or permit the development of training programs for all technologies in every country, regional programs might permit each country to meet its needs for a wide variety of technicians in the numbers needed.

Facilities and faculty can be assembled from several of the technical specialties represented by the team so that common core course work, lecture and laboratory space, etc., can be used most fully.

There is significant need for technicians in the business community of each country. Perhaps several practical technical programs should be established, or even one in each country if the manpower surveys so indicate. Because of the growth of industry in other countries,(13) and the very limited capacity of the new school in San Salvador it is recommended that a technical institute be established in Guatemala. In the South, either Costa Rica or Nicaragua might well serve the training needs of two or more countries. An emerging school (Instituto Politechnico De Nicaragua) gives every indication of becoming a very effective source for the development of technicians in all four of the areas. In the judgment of the team it is a very sound organization with excellent leader-

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[12] See Appendix D.

ship and a strong potential for the future providing its leaders can obtain the $200,000 needed to build a lecture-classroom building for 1,000 students, and shops-laboratories for 400 students concurrently. They have resources for equipping this plant and the land on which to build.

The reactions of Universities to technicians' programs is certainly mixed, but those outside the universities almost universally feel that the technical institutes must have independence to succeed at all. There is also strong sentiment that the governing boards, whether regional or national or local, must have the major representation from prospective employers of technicians.

It is apparent that if regional schools are developed further, each country must contribute significantly in proportion to its participation, especially with regard to student enrollment. It is further believed that no significant movement of students to Institutes in nearby countries will occur unless there are adequate *Becas* (scholarships and aid). Each country may find that it can do more for its own technological development with the resources it has by utilizing institutes in nearby countries for the education of technicians in certain specialties. No one Central American country can afford to provide training for technicians in every technology.

CENTRAL AMERICA

Mid-level Technicians for Agriculture

by Rudger H. Walker

Summary of Recommendations

1. *The greatest need for the improvement of agricultural education at the middle level in Central America is the further development and improvement of the existing schools.*

    a. *A good start has been made in the establishment of these schools, but they all need considerably greater support for facilities, including additional land in most cases, laboratories, classrooms, libraries, dormitories, livestock, modern scientific equipment and farm machinery.*

    b. *These schools are greatly in need of a larger and more realistic operating budget which will permit them to conduct their educational programs in such a manner that they can give students the kind of training they need in keeping with modern scientific agricultural methods and procedures.*

    c. *Undoubtedly of primary importance, each of these schools needs to embark upon a progressive program of improvements, to increase the capability and effectiveness of the present faculty and to employ new faculty members with the right kind of training and experience which will help to strengthen and increase the competence of the entire faculty.*

2. *The school administrators and the national government in each of the Central American countries should promote cooperative technical assistance programs with technical agricultural schools of university schools of agriculture in the United States.*

3. *School administrative bodies should take such action as may be necessary to increase the salaries of teachers to a satisfactory professional level and do whatever else may be necessary to attract good teachers, employ them on a full-time basis, and give them assurances of continuing employment as long as they are capable of rendering effective service as teachers.*

4. *All the agricultural schools of Central America should persistently emphasize the practical training of its students through work on the farms with crops, livestock and machinery using modern scientific methods.*

    a. *A proper balance between scientific theory and practical methods is the ideal to be incorporated into the curriculum of each of the agricultural schools.*

5. *The USAID should extend financial and technical assistance to at least one agricultural school in each of the Central American countries at a level sufficient to promote their effective development in the next few years.*

INTRODUCTION

Because of the great importance of the Agricultural industry the countries of Central America have long been aware of the need for an agricultural school for the training of young men who could fill positions of responsibility in the development and improvement of agriculture.

The pattern was set when the United Fruit Company established the Panamerican School of Agriculture at Zamorano in Honduras in 1941. This school has conducted a three-year program of education where students have been given practical training in the fields, and with livestock and machinery along with the more strictly academic work in the classroom. Upon graduation they are given a certificate of *Perito Agricola*, meaning Agricultural Expert.

Students have been drawn from practically all the Latin American countries and because of the contribution they have been able to make when they return to their home country they have established an excellent reputation for the school at Zamorano which has indeed become a regional school for all of Latin America.

In the intervening years, each of the countries of Central America has established a national school of agriculture patterned more or less after the Panamerican School of Agriculture at Zamorano. The names and locations of these national schools plus a few others closely related are as follows:

Country	Location	Dated Founded	Enrollment
Costa Rica	San Carlos[1]	1970	(2)
Guatemala	Barcena	1944	
Honduras	Catacamas	1941	148
"	La Sabe	1968	
Nicaragua	La Calera[3]	1951	127 (1964)
"	Rivas[4]	1951	182
El Salvador	San Andres	1956	450

[1] Plans have been made for establishment of a second school in about 1974 when the first class graduates from San Carlos. The location of the second school is yet to be determined.

[2] This school is now under construction and the first students will be enrolled in 1971.

[3] The predecessor of this school was founded in 1929 but was moved to the new location in 1951.

[4] This is a private school known as La Escuela Internacional de Agricultura de Rivas and is operated by the Dominican Fathers.

Faculty Improvement

It should be pointed out that some schools have already begun such a program, but they should increase their efforts in this respect–as should all the schools, and continue with the program over a

GUATEMALA

6. *El Instituto Technico Agricultura needs more substantial support from the Government of Guatemala to augment the resources being made available through international agencies.*

  a. *Faculty members need the opportunity for further study to improve their grasp of the methods of modern agriculture.*

  b. *More full-time faculty members are needed on the staff of the institute.*

  c. *More laboratories, machinery, land for experimentation are also needed.*

EL SALVADOR

7. *National and international resources should continue to be devoted to the further development of agricultural education in the National School of Agriculture of El Salvador with the expectation that its training of students from other Central American countries could be expanded.*

NICARAGUA

8. *The National School of Agriculture at La Calera in Nicaragua should be relocated and necessary classrooms, laboratories, dormitories and other facilities should be constructed.*

  a. *During the relocation and redevelopment of this important school, the government of Nicaragua should arrange for continuing advice and consultation from one of the universities in the U.S. with a good agricultural school.*

9. *Encouragement and financial assistance should be provided La Escuela Internacional de Agricultura de Rivas.*

COSTA RICA

10. *Only if the programs of agriculture in the vocational high schools are better supported and services of full-time teachers obtained will the benefits of these programs justify their continuation.*

11. *The recommendations in the report of Dr. S. K. Seaver for strengthening educational programs in agriculture at the National University of Costa Rica should be put into effect.*

12. *The Inter-American Institute of Agricultural Sciences in Costa Rica should continue to receive strong support from the national and international sources which have supported it in the past.*

HONDURAS

13. *The government of Honduras should give stronger financial support to the National School of Agriculture at Catacamas and to the Agricultural School at La Sabe.*

  a. *These schools should be allowed to use the proceeds from the sale of the agricultural products of the school farm.*

  b. *The faculty should be given full authority and responsibility for the academic affairs of this school.*

14. *The Forestry School at Siguatepeque should develop a cooperative working relationship or technical assistance program with one of the good forestry schools in the United States.*

period of years until they can graduate students who can truly serve as agricultural experts in the various phases of modern scientific agriculture.

In Guatemala the National School of Agriculture (El Instituto Tecnico Agricultura) at Barcena has had assistance from the U.S. Agency for International Development in supporting a technical assistance program with California State Polytechnic College at San Luis Obispo. Several Cal Poly faculty members have been at Barcena in recent years so they could assist with such things as curriculum development, improvement of teaching methods and procedures, preparation of laboratory manuals and classroom texts, and to assist in the training of local faculty members, and to replace others temporarily while they are on leave for study and training in schools abroad. This kind of cooperative technical assistance is helping the school at Barcena to improve and strengthen its program in many ways.

At San Andres in El Salvador, a somewhat similar technical assistance program has been and is now in operation between the school of agriculture and the University of Florida under the financial support of USAID. The University of Florida has assigned a vocational agriculture teacher to assist in faculty improvement and curriculum development. Prior to the University of Florida contract personnel from the U.S. Department of Agriculture filled this assignment and were helpful in getting the school started and the educational program under way. Here, too, good progress has been made.

In Costa Rica the government has been assisted immeasurably by the help and guidance of Dr. A. S. Muller of the University of Florida serving as advisor in the USAID. Other University of Florida faculty members have rendered great service in planning for the new agricultural school that is now under construction at San Carlos. Dr. Muller will likely continue to serve as advisor to this school during its formative years. This is fortunate because of Dr. Muller's long years of experience with the work of the agricultural schools at Barcena in Guatemala and with the Panamerican School of Agriculture at Zamorano.

This type of technical assistance is badly needed in each of the national schools of agriculture. It is recommended therefore, that the school administrators and the national government in each of the Central American countries do everything they can to promote some kind of cooperative technical assistance program with one of the technical agricultural schools or a university in the United States which has an effective teaching program in agriculture.

The program should have several facets. It should provide for the assignment of properly trained teachers and administrative personnel to work at the national agricultural school in the respective countries. For most faculty advisors the period of assignment should be for a minimum of two years, and preferably for a longer period to permit ample time to develop significant programs after the usual adjustment and adaptation period. In some instances, however, some short term faculty assignments for men in certain fields of specialization can also be of invaluable assistance in the advisement program and should be used.

The cooperative contract should also provide for the support of some faculty members or outstanding young men who may be good prospects for additional faculty to participate in training and educational programs in agricultural schools and colleges of the United States or other countries where they can have experience and training in the best modern agricultural methods and practices and also where they can be imbued with attitudes and philosophies needed to make the Central American schools effective and productive educational institutions.

Such technical assistance programs should be continued over a period of years, probably a decade or even longer, in order to realize maximum value from the development and improvement programs. Experience has shown the futility of trying to develop effective educational institutions on a short-time basis. Continuity of an effective program of advisement over a period of years has proven to be more effective in the long run and also more economical.

Schools that are particularly in need of this type of technical assistance in the immediate future are the National School of Agriculture at La Calera in Nicaragua and at Catacamas in Honduras. Each of these schools has a special need at the present time. At La Calera the school has been situated adjacent to the Agricultural Experiment Station and near the National Airport. In recent years it has been necessary to extend the runways at the airport and in doing so the school farm lands have been bisected and reduced considerably in size, and also separated from the Experiment Station. The situation was studied by York and Popenoe recently and they recommended that the school be moved entirely to a new location where appropriate land and other facilities can be provided to meet the needs of the school.

We concur in this recommendation and urge that plans be made and steps taken at the earliest possible time to relocate the school and to construct the necessary classrooms, laboratories, dormitories and other facilities needed. It is of vital importance that this school have the guidance and technical assistance that can be obtained through cooperation with an agricultural school or University in the United States during this period of planning, moving to a new location and development of a new campus and educational program. Under the present situation it will be practically impossible for the school at La Calera to develop an effective program of agricultural training and education. In a new location, with new facilities and equipment, modernization of curriculum and methods and with some new and properly trained faculty members this could become an outstanding school and it could perform a real service to agriculture and to the country.

At Catacamas in Honduras, the situation is somewhat different, but the need for technical assistance and increased budgetary support is equally urgent. This school is well located, it has the land and the students are enrolled, but the operating budget is so low it is not possible to employ sufficient faculty members with the necessary training to fulfill the responsibilities of the school. Furthermore, the budgetary support is so low it is not possible to conduct an educational program of the type for which the school was established. This school is desperately in need of a stronger faculty, improved facilities and a larger operational budget.

It is strongly recommended that the government of Honduras give stronger financial support to this school and make a special effort to assist in the development and improvement of it. It would be very helpful if a cooperative program of technical cooperation could be developed with an agricultural school or University in the United States. This should be done, however, only if the other aspects of support can be given simultaneously.

One thing that would be helpful to this school is a change in administrative and budgetary policy which would permit it to retain and utilize the funds obtained from the sale of agricultural products produced on the school farm. This would not only help in a financial way, but it would also serve to encourage more efficient and effective teaching methods. It would help to give both students and faculty a greater sense of obligation and responsibility in their work.

It is recommended that an effort be made to obtain the approval of the Ministry of Education and the government of Honduras to make this change.

This same recommendation would be applicable in the case of other agricultural schools, in other countries, where the sales income is not now retained by the school for its supplementary budgetary support.

The Agricultural School at Catacamas has another problem that warrants a recommendation for change, and this too may be applicable to other agricultural schools in Central America. At the present time the faculty of this school makes a special effort to select for enrollment well-qualified students who are interested in studying agriculture. Examinations are given to determine the student's preparation, and interviews are held with prospective students to make sure they are interested in agriculture. A list of students to be enrolled is then prepared. The list, however, must then be submitted to the Ministry of Education for approval. Customarily this list is changed materially before it is approved and returned to the faculty of the school by eliminating many good prospective agricultural students and by addition to the list of other students who are often not prepared scholastically to do the work or who have little or no background of experience in agriculture nor any interest in studying agriculture. These students do not do well in their academic work and many of them drop out of school after the first term. In doing so they have denied a capable and interested farm boy the opportunity of going to school.

This amounts to administrative interference with the academic program and it is a practice that should be discontinued. It is recommended that the school faculty be given full authority and responsibility for the academic affairs of this school. It is further recommended that this be accepted as institutional policy for the administration and operation in each of the agricultural schools in Central America.

It is recommended that all of the agricultural schools of Central America continue to emphasize the practical training of its students in the fields, with crop and livestock work and the use of machinery, where the application of modern scientific methods can be made under actual farm situations. Scientific training in the classrooms and laboratories is good and should be continued, but without supplementation by practical field training it becomes very ineffective and essentially sterile. A proper balance between the strictly scientific and the practical training is the ideal and should be incorporated into the curriculum in each of the agricultural schools.

Forestry School at Siguatepeque, Honduras

Mention should be made of the new Forestry school in Honduras at Siguatepeque. Although there was no opportunity to visit this school at the time this study was made, the importance of having a good Forestry school in Central American cannot be over-emphasized.

A large proportion of Central America is mountainous and a substantial proportion of the lands are covered with forests. Over much of the area a shifting type of agriculture has been practiced in times past which has resulted in considerable soil erosion. This is a destructive type of agriculture. Not only is erosion promoted and the fertility of the soil depleted, but the value of the watersheds for water conservation is greatly impaired.

The forest lands need management and supervision, and to do this there must be trained foresters who are familiar not only with forest production, but also with the principles of soil and water conservation and the principles of proper land use management. It is important therefore, to develop and maintain a good Forestry school for the effective training of young men in this important field of operation. As is the case with the agricultural schools, the work should be conducted with a good balance between the practical field operations and the scientific principles. Field practices in the various methods of operations is of great importance in the training of foresters who work largely out of doors and have to do with management of the natural resources.

Inasmuch as the need for trained foresters may not be large for a few years it is possible that the school at Siguatepeque in Honduras might well serve as a regional school, where students from all of the Central American countries might go for their training. In this way this school might serve the needs for the training of foresters in much the same manner as the Panamerican School of Agriculture at Zamorano has done for agricultural students.

It is understood that UNESCO has given financial support and advisory assistance to this school during the years since its establishment. It is hoped this support could be continued. In addition this school might find it desirable to enter into a cooperative working relationship with one of the good forestry schools in the United States so they could develop an exchange of teachers and students and thereby obtain considerable assistance and advisory services from well-trained and experienced teachers in the various aspects of forest management and related fields such as soil and water conservation, range and watershed management, and also wildlife management and recreation use.

Some of the agricultural schools in Central America have found it necessary in order to obtain sufficient faculty members to employ on a part-time basis persons whose principal employment is in other government agencies or professional work. This is usually done because of a lack of availability of trained teachers and also because the salary scale is so low that it is impossible to attract competent and well-trained teachers on the low salaries paid for a full-time teaching assignment at the schools.

In practically all cases this kind of arrangement is far less than satisfactory. There are some occasions when a part-time teacher can make an important contribution in the teaching program, but these cases are usually exceptions. The main core of the teaching program should not have to be done by part-time teachers who have a very limited contact with students. The real need is for well-trained faculty members who can be at the school on a full-time basis and available to the students for assistance and consultation as well as for the regular classroom or laboratory teaching.

Although it may seem impossible at first to staff a school with full-time teachers, if salary levels can be raised sufficiently this can be done. With attractive salaries competent young men will find it worthwhile to obtain the necessary training to become teachers and they will be happy to devote their entire time and effort to their school work and make a profession out of it. The importance of this cannot be over-emphasized.

It is recommended, therefore, that the school administrative bodies take such action as may be necessary to increase the salaries of teachers to a satisfactory professional level and do whatever else may be necessary to attract good teachers, employ them on a full-time basis, and give them assurances of continuing employment as long as they are capable of rendering effective service as teachers.

The U.S. Agency for International Development, through its own personnel and through the assistance of contract personnel, has made rather careful studies of the agricultural schools in Central America and it has assisted in many ways in giving technical assistance and financial support to most of them. If there is to be a continuing policy for the U.S. support of these schools, it is recommended that support be extended to at least one agricultural school in each of the countries and that the support be increased to the level where it can bring about effective improvement and development within the next few years so the educational programs will not be delayed for several years in getting started. The need for improvement of the agricultural industry and for the improved economic welfare of the rural people is so great and so urgent in each of these countries that it deserves the strongest support that can be given within the financial ability and bounds of international cooperation between the respective governments.

AGRICULTURE IN CENTRAL AMERICA

Throughout Central America, agriculture is the basic industry. Not only do these countries produce most of the food used for local consumption, but they export substantial quantities of agricultural products. In fact, the agricultural products constitute the principal export commodities and they generate in the neighborhood of two-thirds or more of all foreign exchange. Furthermore, a large percentage of the industries in these countries are involved in the processing, sale or distribution of agricultural products.

All of the Central American countries are mountainous and much of the land is of volcanic origin. The mountains are steep in much of the area and it has been difficult to build roads. This is particularly true in Honduras, and in much of Nicaragua and Guatemala. This has served to impede development in the rural areas even though a high proportion of the land may be under cultivation. On the steep hills and mountain slopes the farms of necessity have been small and most of the work has been done by hand and without benefit of modern machinery.

On the mountain lands coffee and corn are the principal crops. Sugar cane and rice are usually grown at the lower levels near the Atlantic or Pacific coast. Bananas are grown over much of the area, largely for home and local use on the small farms, but for commercial and export trade in the lower coastal areas. Cotton is also grown rather extensively at the lower elevations and is one of the major crops and export products. Altogether the agricultural products of Central America account for 60 to 80 percent or more of all exports and the agricultural sector is the primary source of all foreign exchange.

Because of the tough mountainous nature of the countries of Central America and also the difficulties of building roads, the rural people generally have been quite isolated. Under these conditions it has been difficult to build schools to serve the people. Consequently many children in the rural areas have had little or no opportunity to go to school. Some attend school for one, two or three years, but the drop-out rate is high.

Although each of the Central American countries is now spending a relatively high percentage of its total budget for education, (over 10 percent in the case of El Salvador), the illiteracy rate is relatively high, being 48 percent in El Salvador, 50 percent in Nicaragua and as high as 70 percent in Guatemala. Costa Rica has the lowest percentage of illiteracy, being only 15 percent.

The rate of illiteracy is much higher in the rural areas, running as high as 70 percent in some areas, owing in part at least to the isolation of the people and the difficulty of building schools and retaining teachers to serve in the rural areas. This means that the largest industry in all of Central America, and the one the country depends upon for the production of the food crops and the principal export commodities and approximately three-fourths of the foreign exchange, is operated to a large extent by people who have had little or no opportunity of going to school and who are mostly illiterate. Under these circumstances it is very difficult for the farm people to take advantage of modern scientific methods of production, marketing, storage, and processing of their products. Lack of education denies the farm population their principal contact with the forces of technological change.

All available information points to the fact that production levels on the lands of Central America and in Colombia are relatively low and that they could be increased materially by adoption and use of modern scientific methods now in use in many other parts of the world. For example, it has been demonstrated that corn yields can readily be increased from the usual 10 to 15 bushels per acre in some areas to 40 to 50 bushels per acre, and on the better lands, up to 70 or even 100 bushels per acre through the proper use of nitrogen and phosphate fertilizers and also improved and adapted seed varieties.

Such increases in crop production are not likely to take place without the assistance and guidance of trained personnel, first, to conduct experiments and determine what agricultural practices are best suited for the various crop and soil conditions, and second, to take the information gained through experimentation to the *campesinos* on the farms and teach them through demonstrations and other methods how they can use this information to increase production. This implies and points up the need for trained agricultural workers who can serve as extension and research workers.

Trained agricultural workers of this type are needed by various government agencies involved in agricultural research, rural development, extension teaching, agricultural credit, conservation of natural resources, management of government lands, forests, fisheries, and other related activities. Industries related to agriculture, such as those which manufacture, sell, and distribute fertilizers, herbicides, and farm machinery and also those that process food products or export farm commodities, will also need personnel who have had training in agriculture to aid in conducting their business.

Studies have been made in the various countries of the need for trained personnel in the years ahead. It has been reported that "public and private organizations engaged in agricultural activities have been handicapped by a lack of qualified professionals and technicians." The lack of trained technicians was identified in a study conducted by USAID in 1967 as a key obstacle to more rapid agricultural development.(14)

"Recent estimates by the Academia de Centro America indicate that to meet the goals of this sector program, and to fill the other needs of the agriculture sector, as many as 1,000 agricultural professionals and 3,000 sub-professional technicians may be needed by 1980, against current levels of approximately 400 and 200 respectively."(15)

In a study of the agricultural manpower needs of Costa Rica made by Dr. Daniel E. Allager of the University of Florida in 1967(16) it was pointed out that the needs for *Ing. Agronomos* (University Graduates) was around 400 to 500 and that this was from 100 to 200 more than the number of men with that level of training at that time. He also estimated that there was an undersupply of *agronomos* (egrasados and Zazorano graduates) in the neighborhood of 250 to 300, and of *agricolas* of about 60.

Dr. Alleger estimated that by the year 1980 the following numbers may be required: *Ing. Agronomos*, 600-800; sub-professionals, 400-700; and *peritos agricolas*, 120-200. He concluded that

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[14] AID Loan Paper 515-L-017.

[15] Costa Rica–Agricultural Sector Loan, Section II, Agricultural Education LA-CAEC/P-70/66/2.

[16] The Agricultural Manpower Needs of Costa Rica–A Projection to 1980, by Daniel E. Alleger, University of Florida. Mimeographed Report.

the existing educational institutions in Costa Rica, both at the University and secondary levels, are not adequately prepared either to quickly supply the recognized manpower shortages or to supply the year to year needs.

Commenting further on the situation in Costa Rica, Dr. Alleger states, "Whatever courses of action are taken to improve national educational facilities, the inescapable fact is that the manpower needs for professionals and subprofessionals will rise much faster than the output, at least for the next few years. Not only will 1,000 to 1,500 agricultural professionals and subprofessionals be needed in 1980 for government and private employment in Costa Rica, but the combined need will be much larger in the neighboring Central American nations. Total estimated demand for professionals and subprofessionals could reach 2,500 to 3,000 by 1980, divided equally between the two. No such supplies are currently in sight."

Although specific information is not available pertaining to the precise needs for professional and sub-professional manpower in agriculture in the other Central American countries, there is every reason to believe that the needs are at least as great, if not greater, in the other countries.

Panamerican School of Agriculture at Zamorano

The United Fruit Company has played a very significant role in the field of agricultural education in Central America and Colombia. This company has been engaged in the production and export of bananas from these countries since near the turn of the century. Extensive acreages of bananas have been grown in Honduras, Guatemala, Colombia, Panama and other countries in the Caribbean area. Such crops as abaca (manila hemp), citronella, Honduran mahogany, rubber trees, cinchona, and others adapted to growth in the tropics have been grown and exported.

This company experienced many problems in the development of their agricultural enterprises. Land had to be drained and leveled. Irrigation systems had to be constructed. Transportation systems had to be built. Plant diseases and insect problems were encountered. Most of the people lived in the highlands because of the much lower incidence of tropical diseases than in the lowlands where bananas were produced. When workers were recruited and moved to the banana plantations in the lowlands, health centers, hospitals and schools had to be provided for their welfare. But one of the major problems encountered by this North American Company was the lack of trained manpower to do the work. Men from the United States with technical and scientific training were employed for positions of responsibility on the various company holdings, but they had to learn to adjust their methods and procedures to tropical conditions. Not always could they rely on their previous agricultural experiences gained in the temperate zone. Furthermore, these trained men from the north had to train local nationals in the skills and methods required in the use of modern scientific procedures and methods of production, handling, shipping, storage and related activities.

In no place in the countries where this company was operating were there schools offering practical agricultural training where students could learn the latest scientific methods and procedures. A very high percentage of the working population was illiterate or nearly so. It was evident that this was one of the greatest stumbling blocks to development of the natural resources and of an agricultural industry in the Central American countries.

Because of this situation the United Fruit Company, in addition to operating elementary schools for its employees, decided to establish a school of agriculture for students beyond the elementary schools. This school, known as the *Escuela Agricola Panamericana* (Panamerican School of Agriculture), was established as a private, autonomous institution in 1941 under the laws of the State of Delaware and authorized to function by the Congress of the Republic of Honduras, and was located in the Zamorano Valley in Honduras.

The objective of this school was to provide an opportunity for training and education in the practical and scientific aspects of agriculture for promising young men from the various Latin American countries. The students were to "learn by doing" under expert supervision in the gardens, fields and orchards. They would obtain first-hand experience in the use of modern agricultural equipment and machinery and they would work with all types of livestock. Upon successful completion of the three-year course of study the students were given the official recognition of *Agronomo*. This is not equivalent to the Bachelor's degree level in the U.S. and is considered to be on the middle level of agricultural training.

This school has been financed largely by an endowment established by the United Fruit Company, and by contributions from individuals, corporations and foundations. Significant financial assistance has been given by the U.S. Government through AID.

At the time of completion of the 1969 school year the total number of graduates was 1,168. Presumably the number of graduates now exceeds 1,200. Although the school is located in Honduras it is not a national school of that country, but rather it serves the students of nearly all the Latin American countries. Its students have come largely from the Central American Republics, Panama, Colombia and Ecuador. Graduates have found employment in the countries throughout Latin America. Several graduates have gone to the United States to complete the work for the B.S. degree and many have continued their studies for the Master's degree. It can safely be stated that most of them have found employment in positions of responsibility and have contributed immeasurably to the development and progress of the agricultural industry in this region.

Many of the graduates of EAP have become leaders in agriculture in Central and South America. They have been and are now employed in important and responsible positions in agricultural production, processing, marketing and export trade. They have served as teachers and administrators in EAP and other national schools, and they have held important positions in government. A good example is Francisco Lino Oseguada Jimenex who, upon completion of his studies at Zamorano, studied at the University of Florida. He then was employed as a teacher at EAP. After some time at EAP he returned to his home country, El Salvador, where he served as a teacher and then Director of the agricultural school at San Andres. He is now serving as Subsecratario de Agricultura y Ganaderia (Assistant Secretary in the Ministry of Agriculture). This is one of the highest positions of responsibility in the Ministry of Agriculture in El Salvador.

The Panamerican School of Agriculture is now planning to extend its curriculum to provide a fourth year of training for a small number of selected students, who, upon completion, will be granted the degree of *Ing. Agronomo*. An agreement between the Escuela Agricola Panamericana and the National Autonomous University of Honduras provides for recognition of the two degrees. The *Ing. Agronomo* degree will be the equivalent to that given by the National Universities in the various countries of Central America and also to the B.S. degree granted by the Colleges and Universities in the United States.

The additional year of training at EAP will serve to train men for somewhat higher positions of responsibility than those completing the three year program, and will provide men for the higher positions of leadership in agriculture in this part of the world.

The Panamerican School of Agriculture at Zamorano has demonstrated what can be done for agricultural education in Central America and in the South American countries. It has stimulated other countries in this region to establish similar schools and has served as a pattern for administration, curriculum and mode of operation. It is the one school of the area that is held up as a pattern for operation and as a goal for achievement in local national schools.

Although each of the countries in Central America and several in South America sent students to the Panamerican School of Agriculture in Honduras the number being trained was not enough to meet the needs for improvement and development of agriculture in the respective countries. As a result, most of the countries in the area set up a national school of agriculture patterned after the school at Zamorano.

GUATEMALA

In Guatemala a National School of Agriculture was established in 1944 at Baircena, in the Municipality of Villa Nueva, 20 kilometers from the capital city. An agricultural school had been in operation there since 1921. Then the Central American School of Forestry (Forestal Centroamericana) was consolidated with the agricultural school in 1969, and the combined institution was named El Instituto Tecnico Agricultura.

This school has been giving a three year course in practical agriculture, patterned after the Panamerican School of Agriculture at Zamorano. Between 1940 and 1969, 1,689 students were enrolled and 615 were graduated as *Peritos Agronomos*.

In 1970 this school embarked on an expanded program to give, in addition to a three-year course in general agriculture, specialized training for qualified students in one of the following subjects: 1. farm administration, 2. forestry, 3. crop production, 4. crop protection, 5. livestock production. The livestock production program was started in July 1970, by the addition of four new teachers to the faculty. It is planned to start the specialized Forestry program in the near future and the other new curricula as soon as it is feasible to do so. Thirty students will be enrolled in each of these specialized curricula. Students completing these specialized courses will be graduated with the degree *Ing. Agricola*, which is equivalent to the Bachelor's degree in American Universities.

The ITA at Baircena has a loan from the International Development Bank in the amount of $1,200,000 for construction of new laboratories, classrooms, dormitories, cafeteria and other facilities. Construction is to be started in December 1970. This school is administered under the Ministry of Agriculture of Guatemala and receives its principal financial support from the Government of Guatemala. In recent years it has had financial support and professional assistance from the U.S. Agency for International Development. Currently the California Polytechnical Institute at San Luis Obsipo has a contract with AID and the Government of Guatemala to give technical assistance to this school. This contract program is now under the leadership of Kermit H. Adams, and associated with him are three or four professional men trained in agricultural education, horticulture, plant pathology, animal husbandry, and other fields of agricultural specialization.

Significant progress is being made in the development of this school, but it is obvious that much remains to be done to develop it to the standard of quality that is needed for the training of young men in the various aspects of modern scientific agriculture. In the first place, this school needs more substantial support from the Government of Guatemala in order to provide it with the necessary facilities and a strong faculty. As was found to be the case in all of the schools of Central America, the faculty members should be given the opportunity for further study and improvement in the methods and practices of modern agricultural procedures. Some additional faculty members will need to be added to the faculty in order that the students can have the individualized instruction needed where practical agricultural training is to be given along with the science and theory of agriculture. Additional laboratories and equipment, farm machinery, land for experimentation and other facilities will be needed to help this school develop its program and improve the teaching practices to the point where it can train young men to meet the problems of modern scientific agriculture.

EL SALVADOR

The National School of Agriculture of El Salvador (Escuela Nacional De Agricultura de El Salvador–ENA) was founded in 1956. It is located in the Valley of San Andres about midway between San Salvador and Santa Ana, on the West side of the Panamerican Highway. The school farm comprises 113 hectares of good arable land.

This school has a three-year program of theoretical and practical training in agriculture and awards the degree of *Perito Agricola* (Agricultural Expert) to students who successfully complete the assigned work. Field work and laboratory studies are conducted in the forenoon and classes are conducted in the afternoon throughout the week. The school operates on a trimester basis of 15½ weeks each, and the students have one month vacation each year.

The curriculum is organized under six departments: Basic Science, Agricultural Mathematics, Agricultural Economics, Horticulture, Agronomy and Animal Science. The faculty consists of 28 professors and 22 instructors. During the formative years of this school several U.S. technical advisors assisted in developing the courses of study, the methods of teaching, and in the problems of organization and administration. Also, various international organizations such as UNESCO, CIDA (International Committee for Agricultural Development), IICA (Interamerican Institute of Agricultural Collaboration), and others, have assisted in the development of this school in one way or another. At the present time the U.S. Agency for International Development is giving assistance to the school through a contract with the University of Florida, and Dr. Harry E. Pierce is serving as Advisor in Agricultural Education at the school.

The enrollment in 1970 was 430 students, and it was expected that approximately 120 would graduate at the end of the academic year. Graduates of the school, including those who graduated in December 1969, number 558, the majority being Salvadoreans. The school admits a total of 10 students from other Central American countries. Close to 30 percent of the graduates work for the Government in its various divisions, such as Extension Service, Administration of Peasant Welfare, Institute of Rural Colonization and others. The rest of them work with private farmers.

NICARAGUA

According to the 1957 census, Nicaragua had 7.3 million acres of farm land, approximately 2/3 of which was in crops and pastures. The 1963 census indicated that there were some 100,000 farms in Nicaragua. One-third of these were less than 5 *manzanas* in size (1 *manzana* equals 1.74 acres). In fact, 62% of all farms were less than 20 *manzanas*.

Nicaragua has relatively large areas of land which could be used for agricultural purposes, not only in the eastern part of the country, but in the Pacific and Central regions as well. Furthermore, the climate, topography, and soil conditions are generally favorable for the further development of a wide variety of crop and livestock enterprises.

As much as 175,000 acres of land could be irrigated eventually under large scale projects.

The population of Nicaragua in 1965 was estimated to be approximately 1,634,000 with 60% of the people living in rural areas. The 1964 census showed 66.5% of the "economically active" population was engaged in agriculture. With an annual rate of 3%, it is estimated that the population will double within the next 20 years.

Agriculture truly represents the foundation of the Nicaraguan economy. In 1964 the agriculture sector (including livestock) was responsible for approximately 36% of the nation's gross domestic product (GDP). By comparison, commerce and industry, the next two most important contributors to the GDP, accounted for only 20% and 14% respectively.

Agricultural products accounted for approximately 85% of the country's exports. Two crops, cotton and coffee, were responsible for 2/3 of all export sales last year.

National Agricultural School (ENAG)

In 1965 York and Popenoe(17) made a study of agricultural development in Nicaragua and they made the following comments about the National Agricultural School.

> The National School of Agriculture is the only institution of higher agricultural education in Nicaragua. It was founded in 1929 as a branch of the Ministry of Agriculture. At that time, it was located in Chinandega and offered high school degrees in agriculture. The School was transferred to its present site in "La Calera" in 1951, where it adjoins the Experiment Station. The School does not belong to the National University of Nicaragua, though all courses are university level. The School gives diplomas of graduation, the degree of "Ingeniero Agronomo" is awarded by the President of the Republic, the same procedure which is followed by the National University. The School was granted semi-autonomous status in 1964 when the new Lay Organice was passed. Total budget for the School in 1965 is 1,112,570 cordobas.
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> The School has 21 hectares of land which are used for teaching, demonstration and commercial production. The buildings are valued at three million cordobas. Most of the activities are housed in three main buildings - a dormitory, a dining room and kitchen, and the main building which houses the offices, class rooms, laboratories, and library. Laboratories are available for the teaching of biology, botany, physics, chemistry, agricultural engineering, and veterinary medicine. The library houses 6,000 volumes and 14 subscriptions of periodical magazines. Most of the text books are in English.

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(17) Agricultural Development in Nicaragua - with particular reference to the Organization and Programs of the Ministry of Agriculture. A Report of a study team by E. T. York and Hugh Popenoe representing the U.S.D.A. PASA team in Nicaragua - U.S.D.A. cooperating with the Agency for International Development, September-October, 1965.

The faculty of the School at present is made up of 24 teachers, although the number varies greatly from semester to semester. Of these, three are full-time, two are half-time, and the rest work part-time. All faculty members have the title *Ingeniero Agronomo*, or its equivalent, and some have higher degrees. Six faculty members are now outside of the country receiving advanced training at other institutions. The full-time professors get an equivalent salary of C$3600/month. However, most faculty members are paid by the hour for teaching. Hourly rates are the equivalent of those offered at the National University and C$30/period for lecturing and C$20/period for laboratory. The periods are 45 minutes in length.

The present curriculum is 10 semesters long, or five years. Semesters start in June and November. All applicants must be high school graduates and have to take an admission test. Approximately 80 percent of the students that apply are admitted. The number of students who drop out the first year is high, and at times may be as much as 70%. The following table shows the number of students in various categories for the period 1960-64:

	1960	1961	1962	1963	1964
No. of applicants	72	86	59	57	72
No. admitted	63	67	49	52	52
No. who entered	55	62	42	49	31
Total No. Students	119	127	111	119	127
No. in Fifth Year	10	14	19	12	13

Since the School started its university-level program in 1956, 78 students have completed the course work. However, only 23 of these were awarded the *Ingeniero Agronomo* degree, the remainder not completing the required thesis. Adequate supervision is not available to enable all students to carry out research projects. Nevertheless, local job opportunities are approximately the same for the two groups. A problem arises when a student wants to take advanced work outside the country, in which case the students who are not awarded the diploma are usually not accepted as regular students. Approximately half of the previous graduates are now working for the government.

The government provides scholarships for all students who make a grade of 80 or above. This represents half of the total. Students who make grades between 70 and 80 are required to pay 150 *cordobas* ($21.00) per month. Students who make grades between 66 and 70 (66 is the minimum grade for passing) must pay 225 *cordobas* ($31.50) per month. The total cost for maintaining a student for one month is estimated to be almost 1,000 *cordobas* ($140.00).

This important National School of Agriculture has many problems. In the first place, the classroom and laboratory building is entirely inadequate and poorly equipped to give modern-day university training in agriculture. Of equal seriousness, however, is the fact that the school lands have been situated near the National Airport. In recent years, as it has been necessary to expand the airport and extend the runways there has been no alternative than to extend onto the school lands. In fact the extended runways have bisected the farm lands and separated them from the experiment station lands, which are also under the supervision of the Ministry of Agriculture. For the present time this is a great handicap to the school of agriculture because its facilities for giving practical agricultural training to its students have been greatly reduced and hence the program restricted. But what appears to be a handicap now may turn out to be a blessing in disguise, provided the Ministry of Agriculture takes steps to relocate the school as it should do by all means, and as soon as possible.

Plans should be developed immediately, and action taken as soon as possible to relocate this school in an area somewhat removed from the capital city, where encroachment from other developments are not likely to occur, and where ample land representative of Nicaraguan agriculture can be acquired and made available for this important National School of Agriculture.

Inasmuch as the Agricultural Experiment Station, which is also under the administrative control of the Ministry of Agriculture, is in the same predicament, it would be highly desirable to move both institutions at the same time, and also to consolidate their functions to the fullest extent possible. The close relationship between the teaching and research functions has done much to lay the ground work for success in the colleges of agriculture in the United States, and such consolidation would undoubtedly serve the same purposes in Nicaragua. Under this kind of situation students can become involved in the various agricultural research projects and while they are gaining practical experience and learning the skills of scientific agricultural procedures they can also experience the inspiration of scientific investigation and enjoy the satisfaction of developing new knowledge for the benefit of agricultural improvement.

Plans should also be made for construction of an entirely new campus, at the new location for this National School of Agriculture. This is an opportunity many schools do not have. This will permit the school to take advantage of modern architectural planning and the development of modern laboratory facilities which are now lacking and so desperately needed for appropriate training in modern scientific agriculture. Development in a new location will also make it possible to develop plans for effective and efficient training in the practical skills and managerial aspects of agriculture.

In making a major change of this kind which not only involves a move to a new location but also makes possible the development of new curricula and teaching methods, it would appear to be highly desirable to acquire the best outside consulting services possible.

It is recommended that the Nicaraguan Ministry of Agriculture consider very seriously the possibilities of developing some kind of contractual relationships with one of the universities of the United States where they have a good college of agriculture, to serve on an advisory or consulting basis over a period of years during the planning and construction stages while a new campus is being developed for the National School of Agriculture (Escuela Nacional de Agricultura Y Ganadoria).

It is also recommended that a few members of the faculty of this school be provided with some kind of training grant which will make it possible for them to acquire additional training in the various aspects of modern scientific agriculture and in the methods and procedures of teaching both the practical and theoretical aspects of agriculture. Every possible move should be taken to upgrade and improve the quality of the teaching that will be done in this new school.

Greater financial support will need to be provided for this school to enable it to function properly as a National School of Agriculture. The primary source of this support obviously will need to come from the Government of Nicaragua, but some outside grants or loans for specialized activities may be sought to aid during the difficult and costly years of relocation and curriculum building. Such financial assistance may be sought through the International Development Bank, the U.S. Agency for International Development, the Organization of American States, various foundations or similar sources.

This school is urgently needed in Nicaragua for the training of young men and women who can serve as agricultural leaders, and teachers and to aid in the development of the agricultural resources and in the increased productivity of the land and human resources of this country.

La Escuela Internacional de Agricultura de Rivas

This school is located in the city of Rivas in the southern part of Nicaragua. It was established in 1951 under the supervision of the order of the *Predicadores* or Dominican Fathers, and although it is a private school it was inaugurated by the President of the Republic of Nicaragua. It has a total land area of 73 *manzanas* (124 acres) and has classroom and laboratory buildings, a library and some buildings for farm animals and machinery.

In the summer of 1970 there were 182 students enrolled. During the 17 years since its opening 527 students have graduated from the three-year training program and awarded the certificate of *Perito Agronomo*.

Graduates of the school have found employment in various agencies including the National Bank, Agrarian Reform Institute, National Development Institute, Agricultural Experiment Station and others. None have become teachers.

Inasmuch as this is a private school it does not get direct support from the Government. It is dependent upon tuition paid by the students and private contributions. The U.S. Agency for International Development has given some assistance by way of a long term loan in recent years.

The information available indicates that this school is doing fairly well in its educational program. Like most schools, however, it is operating on a very low budget, and it is therefore restricted in the kind of training program it can conduct. Although some additional buildings are under construction, it needs additional facilities, buildings and equipment, including livestock and farm machinery.

This school has the potential of training a substantial number of students each year, and could give training of good quality if it had somewhat better financial support. Encouragement should be given to this school and financial assistance if possible, to help this school improve its program and continue on during the years ahead.

COSTA RICA

The importance of giving students an opportunity to study the fundamentals of agriculture in the secondary schools has been recognized by officials in the Ministry of Education for several years. A program of vocational agriculture has been included in the curriculum in 10 high schools and a number of students in each of these schools choose to follow this course of study. Two members of the Field Team visited one of these high schools at Puriscal.

It can be stated in fairness that the quality of the vocational agriculture program in these high schools is much below any reasonable standard of expectation and the success of the program is surely less than had been anticipated by its founders. Unfortunately these schools have not been supported adequately to conduct an effective program of vocational agriculture. Not only has there been a lack of facilities, such as land, livestock, machinery, and laboratory space and equipment, but of even more importance, these schools have not had teachers who have had training in the principles and procedures of modern scientific agriculture, nor have they had training in the methods of teaching vocational agriculture. Very few of them have had the benefits of a university education.

Unfortunately, the salaries paid to high school teachers is not sufficient to encourage capable young men to go to the expense of obtaining a university education and to prepare for a professional career as a teacher. As a result the high schools have had to engage the services of individuals with less than the necessary training. In many instances they have obtained the services of local extension workers or other government officials to teach an hour or two at a time on certain days of the week.

This has helped some, but these persons have not always been able to meet with the students as planned. Part-time teachers can never meet the needs of students as well as full-time teachers who are properly trained and available to work with and teach the students on a continuing basis.

Unless these programs of vocational agriculture in the high schools can be better appointed and the full-time service of qualified teachers can be obtained, it is doubtful that the benefits derived from the program will justify its continuation. As the program is now operating there is a tendency for students with little or no interest in agriculture to enroll in vocational agriculture because it is an easy way to get through high school and obtain the credentials for entrance to the university. The program as conducted neither trains the needed manpower for agriculture nor gives students the quality of training needed for good preparation for university work.

College of Agriculture–National University of Costa Rica

Until the present time the only other place for students to obtain training in agriculture has been the Facultad de Agronomia of the National University of Costa Rica. This is one of the newer colleges in the University.

Unfortunately the educational program in the University has followed the traditional pattern so common in many of the European Universities. As a result, major emphasis has been given to the theoretical aspects of agriculture, with little or no practical training in modern agricultural methods and procedures. Research and investigation has dominated the program.

Another shortcoming is the fact that most of the students who enroll in the College of Agriculture are those who have grown up in the city and who have had no experience in actual farm operations and they have little or no interest in agriculture itself, only in certain aspects of the scientific principles involved.

Another very serious roadblock in the training of manpower in the advanced phases of agricultural education is related to the educational policies and standards established by the faculty. Experience indicates that students customarily fail about fifty percent of their courses each year, hence they have to repeat these courses the following year. This slows down the progress of the students materially and as a result it takes an average of about 14 years to complete the course of study for graduation for the *Ing. Agronomo* degree.

Very few students can afford to attend school so many years to obtain a university education. Besides the financial cost of going to school they are delayed in starting their productive life and professional career.

This kind of educational program is not only costly to the student but also to the government that has to finance it.

Although the University has autonomous status and the faculty members have a tight tenure situation, they should give serious consideration to modifying their policies and teaching methods in order that they can be more productive in the education and training of young people and in meeting the manpower needs of the nation. No nation can afford to depend on the antiquated methods being followed when the needs are so great to meet the challenge of modern scientific progress in agriculture or in any other field.

Dr. S. K. Seaver of the University of Florida made "An Evaluation of Undergraduate, Graduate and Research Programs at the University of Costa Rica" in 1967. In his report many recommendations were made for improvement and strengthening of the educational programs in agriculture, at the University. It is understood that the University has already made some of the changes suggested and is following through on others. It is recommended here that full consideration be given to Dr. Seaver's report and implementation of his recommendations.

Under the new agricultural development loan program between the government of Costa Rica and USAID considerable effort will be directed toward improvement of the college of agriculture. The plans call for increasing the total student enrollment in agriculture and the graduation of about 40 students each year with the *Ing. Agronomo* degree. This will contribute materially toward meeting the manpower requirements for teachers in the high schools, and the intermediate level agriculture schools and also for personnel for the Extension Service and research workers in the Agricultural Experiment Stations.

These changes at the University should in time contribute materially toward the improvement and development of agriculture in all of its facets throughout Costa Rica.

Intermediate Education in Agriculture

As a part of the over-all study of agricultural education in Costa Rica made under the contract with the University of Florida in 1967, a very careful study was made of the need for agricultural schools on the intermediate or sub-professional level. The results are contained in the following reports:

1. Agricultural Education in Costa Rica, by Dr. A. S. Muller, University of Florida/AID Contract Consultant, March, 1969.
2. Agricultural Manpower needs of Costa Rica: A Projection to 1980, Dr. D. E. Alleger, University of Florida/AID Contract Consultant, 1967.
3. An Evaluation of the Program of Agricultural Education at the Secondary Level in Costa Rica, Dr. J. E. Christiansen, University of Florida/AID Contract Consultant, 1967.
4. Survey of Higher Agricultural Education and Research in the Area of Animal Science, James F. Hentges, Jr., University of Florida Report, AID Contract, September 15, 1967.
5. A Proposal for Sub-Professional Agricultural Education in Costa Rica, Dr. A. S. Muller, University of Florida/AID Contract Consultant, March, 1968.
6. Costa Rica: Agricultural Development Program, AID Capital Assistance Paper, June 16, 1970.

Dr. A. S. Muller, who is employed by the University of Florida on the AID Contract in Costa Rica, has made an invaluable contribution in this planning effort. He has been in a unique situation to contribute to the planning for agricultural education, inasmuch as he has been engaged in agricultural education programs in Central America for more than a quarter century. He has been Director of the National School of Agriculture at Baircena, Guatemala, and a member of the faculty and

Director of the Panamerican School of Agriculture at Zamorano, Honduras, and has filled many other special assignments.

On the basis of the surveys and plans made, the government of Costa Rica and USAID, signed a cooperative agreement in April, 1970 for the further support of agricultural development in Costa Rica. One phase of this agreement provides for the construction and development of two agricultural schools to operate on the intermediate or sub-professional level and patterned after the Panamerican School at Zamorano. The first of these schools is to be located in San Carlos and was scheduled to be constructed during the winter months of 1970-71 and ready for the opening of school in 1971.

This school will be semi-autonomous and will function under a Board of Trustees on which the Ministry of Agriculture, the Ministry of Education and also University of Costa Rica will be represented. The Dean of the College of Agriculture in the University will serve as President of the Board of Trustees. Dr. Muller will serve on the Board of Trustees and he will also serve as Advisor to the Director of the School.

It is planned to get this school at San Carlos into full operation and graduate the first class before starting the second school. The location of the second school is yet to be determined.

Inter-American Institute of Agricultural Sciences

In Costa Rica, there is also a graduate school of agriculture located at Turrialba, and known as the Interamerican Institute of Agricultural Sciences of the Organization of American States (IICA). "The general objective of this institute is to stimulate and advance the development of the Agricultural Sciences in the American Republics through research and training, and by propagating the theory and demonstrating the practices of agriculture and related sciences." This is a regional school operating strictly on a graduate level. No work is given on the junior or senior college level. This institution has an enrollment of approximately 100 students per year, and about the same number of research projects are conducted annually by students and faculty.

Plans are to train at least 400 students at the Masters level who can then serve as faculty members of the various national schools of agriculture or conduct research in the national Agricultural Experiment Stations.

Although this school is operating at the graduate level it forms an important link in the over-all program of agricultural education. It should be given continued support in order that it in turn can support and aid in the development and improvement of the various national schools of agriculture.

The Institute derives its income from fixed contributions of the member nations of the Organization of American States; from special contracts with official agencies of the American States, such as the U.S. Agency for International Development (AID), and the U.S. Atomic Energy Commission (AEC); from grants awarded by philanthropic foundations and private industry; from the multinational project of Agricultural Sciences of the OAS; and from its own agricultural endeavors which include the production mainly of coffee, cacao, sugar cane and dairy products.

It is recommended that each of these agencies give strong support to this Institution in order that it can fulfill its intended purposes. Upon the effectiveness with which this institution fulfills its purposes and objectives in the proper training of teachers will depend to a considerable extent the success of the middle schools of agriculture in the Latin American countries.

HONDURAS

Although the Panamerican School of Agriculture is located in Honduras, it is operating as an international institution to serve all of the Latin American countries. Consequently its enrollment policy is geared to encourage a few students from each of the countries rather than a large number from a few countries. As a result the total number of students enrolled from Honduras is usually about the same as from the other countries.

A total of only 263 students from Honduras have been graduated from the school since its opening in 1941. The number of Honduran students graduated per year has varied from 4 to 17 during the past 15 years. Although this has been a great help to Honduras it has not provided the number of trained personnel that is needed for the development of the agricultural resources and improvement of agriculture in Honduras. In fact all indications point to a great scarcity of trained manpower in the agricultural industry in this country. It has been estimated by the Office of Education Planning that 208 *Ing. Agricola* will be needed during the next two years. It is very doubtful that anywhere near this number of trained men will become available in this short period. This need for trained men has been recognized by government officials in Honduras for the past several years, and for this reason a school for vocational training in agriculture was established at Catacamas in 1952, and another was established in 1968 at La Sabe.

Agricultural School at Catacamas

The school at Catacamas is known as La Escuela Nacional de Agricultura. It is well-located in a productive agricultural valley in the north east where students can be given good experience in the various phases of practical agricultural production.

This school is administered under the government ministry of education. It offers a three-year program which is patterned largely after that of the Panamerican School at Zamorano. It has 16 faculty members and an enrollment of 148 students. Three of the faculty members have graduated from the Panamerican School of Agriculture at Zamorano; others are graduates of other schools where they majored in Mathematics, Chemistry, Spanish or the other usual academic subjects.

This school has been confronted with several operational problems which have kept it from rendering the service it should to its students and toward development of Honduran agriculture. First is the lack of adequate financial support. This school is desperately in need of additional building facilities for classrooms, laboratories, library and dormitories. It needs additional funds for general operational expenses.

One thing that would help this school is the privilege of retaining the income derived from the sale of agricultural products produced on the farm. At present the school is required to turn in the sales income to the Ministry of Education. If the school was permitted to retain the sales income it would not only help to improve the financial position of the school which is urgently needed, but of equal importance is the added incentive it would give to students and faculty to use more efficient methods of production and management. This would serve to improve the quality of the teaching in the school.

It would appear that the effectiveness of this school could be greatly improved by establishing a definite program for improvement and up-grading of the faculty. Faculty members should be given the opportunity for advanced training in some other university, where they can obtain training in the methods and procedures of modern scientific agriculture and also effective teaching methods. Special care should be exercised in the employment of new faculty members to make sure they have the scholastic aptitude and training to be effective teachers. At the same time faculty salaries should be increased to a level that will permit and insure employment of only the most competent and best-trained individuals to serve as teachers. At the present time, it appears that the level of faculty salaries is so low that it is not possible to obtain and retain the services of well-trained teachers. This situation needs to be corrected in order to bring about the improvements needed in this important school.

Finally the faculty of this school needs to be given the responsibilities ordinarily held by secondary schools and schools of higher education in matters pertaining to the academic activities of the institution. Particularly in this case reference is made to the enrollment of students. It has been the practice for the faculty to conduct entrance examinations for prospective and interested students. From the results of these entrance examinations a list of students is established for enrollment. Unfortunately, however, this list now must be submitted to the Ministry of Education for approval. There the list is revised and a final list of approved students is prepared, and often without reference to the results of the entrance examinations nor the qualifications or interests of the students in studying agriculture. Usually the faculty, therefore, is given a list of students who are neither qualified nor interested in studying agriculture. Many of these students drop out during the school year or fail in their studies. Hence, agricultural training is given to students with no agricultural background and with no interest in agriculture nor intention of continuing in agriculture work.

The administrative officers and the faculty of the school should be given responsibility for supervising and conducting the academic affairs of this school without pressures or interference from the political leaders or government officials. This is an item of primary importance in the development of an effective educational program. This same principle of operation should apply in other schools of agriculture and forestry.

This National School of Agriculture at Catacamas has the potential of developing into an effective institution. It is here that Honduras has the potential for developing an agricultural school where students can be given the practical training and the theoretical aspects of modern scientific agriculture.

This school should be given substantial support to build up its physical facilities, strengthen and improve the faculty and to aid in improving the teaching methods and procedures. It should also be delegated the authority customarily given to educational institutions to supervise and conduct the academic program within the school without interference or control from outside sources.

Agricultural School at La Sabe

A second school of agriculture was started in 1968 at La Sabe where it is located in the important agricultural area near the north coast of Honduras. This school is also operating on the Junior College level and is patterned after the Panamerican School at Zamorano. The comments made previously about the school at Catacamas also apply to this school. It has the possibility of becoming a good agricultural school, provided it is given adequate facilities, a good faculty, strong budgetary support and the freedom and responsibility of operating the academic phases of the school without outside interference.

Forestry School at Siguatepeque

In 1969 a Forestry school, Escuela Nacional de Ciencias Forestales Siguatepeque in Comayagua, was founded. This was a very important new development in the right direction for the training of needed manpower for the development of agriculture and the natural resources of Honduras.

Much of the land area in Honduras is mountainous, and not well suited to cultivated agriculture. A shifting cultivation type of agriculture has been followed in many places, resulting in severe erosion as well as destruction of the native forest. Honduras has great potential in the production of valuable forest products which will have important domestic use but also will be of considerable economic significance for export.

It is also of primary importance to Honduras to develop an effective forest and range management program in order to protect the watersheds and preserve the important water supplies.

In order to develop the natural resources of Honduras and other countries of Central America it will be necessary to have trained manpower to supervise and manage the forest and range lands, the watersheds and mountainous areas. A good School of Forestry is needed for this purpose.

The development and maintenance of a strong school of Forestry is one of the important links in the development of the natural resources of the country, and indeed, the welfare of the people, and the economy of the nation.

This school will need strong budgetary support to furnish the necessary facilities, buildings, lands, experimental forest and watershed areas, a well-trained faculty, an up-to-date curriculum, and adequate operating funds.

It is understood that this forestry school has had technical assistance and guidance from UNESCO. This is very fortunate, for in the beginning years of a technical institution of this type it is very important to have guidance in development of the curriculum and in teaching methods and procedures. It is hoped this cooperative relationship with UNESCO can be continued for a few additional years.

It is also suggested that this school might also benefit by developing a cooperative working relationship or technical assistance program with one of the good Forestry Schools of the United States. An exchange of faculty members between the two schools would be mutually beneficial. This would assist in giving the faculty members training and experience in modern forest management procedures and help to up-grade the faculty in general. Such a technical assistance contract might well be initiated and given some financial support by USAID. Inasmuch as Utah State University has several contracts with AID for technical assistance in agriculture and irrigation the USU College of Natural Resources might well be an appropriate forestry school to look to for cooperation in technical assistance with this school.

CENTRAL AMERICA

Mid-level Technicians for Business

Summary of Recommendations

The Central American region is undergoing rapid change in the direction of more complex economic activity. The change in the environment has caused a sharp increase in the demand for qualified business management technicians. This study indicates that the need for trained personnel in business is particularly urgent at the intermediate level and that the demand is going to increase in the near future.

The existing educational system has been slow to adjust to the needs of the environment. In the majority of cases, the system does not have the capability or desire to undertake technician-level training in business. To alleviate the shortage of management personnel and to improve the economic performance of existing enterprise, the following recommendations should be implemented in the near future:

1. *The establishment of a technological institute in each country which will, among others, offer programs designed to fill the gap in the existing education system in the formation of intermediate level personnel in business management.*

2. *The proposed institute should be organized on an experimental basis to allow maximum flexibility and the opportunity to innovate. The programs of the institute should be coordinated with the overall national educational planning, while at the same time the operational independence of the institute should be preserved. The administration as well as the budget should be separate from the existing educational institutions.*

3. *To accomplish its objectives, it will be necessary that the institute take a new approach in determining admission requirements, curriculum development, teaching technology, faculty development, and student service.*

4. *The core curriculum should provide the students with knowledge of the primary functional areas of management. The specialization options should be developed to meet the managerial manpower needs of economic organizations in the vicinity of the institute.*

5. *Business leaders should be encouraged to assume an active role in policy making, support (moral and financial), and providing the students with on-the-job training opportunities. The advantages of this cooperative approach are as great for the students as for the business organizations.*

6. *A regional teacher training institute should be established to serve the needs of all institutes located in the various countries. The institute would also conduct pilot programs for experimentation with new teaching technology and materials. The regional center should also provide technical assistance to the new institutes throughout the region. It is expected that this facility would provide continuous programs for the improvement of teaching at the intermediate level.*

7. *It would be highly desirable that the institute should have its own physical facilities. Recognizing the extensive lead time involved, any suitable public or private facility should be used for the interim period.*

8. *Outside technical assistance should be obtained to assist in the planning and implementation of the institute programs. Foreign technicians should function on a counterpart basis with local technicians who would take over as soon as the training period is completed. Because the fundamental problems of developing intermediate management technicians are similar, it is proposed that the technical assistance be provided on a regional basis.*

9. *An institute should be established in every major industrial or commercial center of the region. This will represent at least one institute in each country and several in a country where demand exists. This recommendation is based on the fact that employment opportunities in various business management occupations are very extensive. Not all specialization options should be offered at each location. There are a number of business occupations for which only a regional demand would provide sufficient numbers of students.*

10. *An educational information program should be initiated by the institute to gain the acceptance of the new level professional among the business community, potential students, and society in general.*

The Demand for Business Management Technicians in Central America

Surveys of existing research materials and interviews with hundreds of business managers, government officials, and educators strongly indicate an urgent need for intermediate level technicians in business. Unless this need is met in the near future, the lack of qualified managerial talent will strangulate further economic progress. The existing educational systems have neglected intermediate training in business and therefore have failed to serve the goals of economic and social development. The need for intermediate-level technicians is widely recognized in business and government as well as by some leaders in the educational systems. Some planning is in progress; and in a few cases, modest programs have been initiated. There is also considerable evidence that prospective employers are willing to support intermediate business technician programs in tangible ways.

There are clear indications that the demand for management technicians is going to increase substantially in the next few years. The basic cause is the fundamental social and economic changes that are taking place in the Central American region which were set in motion by economic integration efforts. There are few business firms that have not felt the impact of these changes. Most business managers recognize that their methods of operation must be changed, and the change is unmistakable in the direction of greater managerial sophistication. The need for improved management technology is forced by the greater complexity of business which is brought about by economic integration. Firms no longer operate in small, isolated and protected markets; they are being forced to compete on a regional basis. The ability to compete will depend on the quality of management. Therefore, the very economic survival of the firms will hinge on their ability to find managerial talent.

Various regional and national human resource studies indicate that the need to train managerial specialists far exceeds any present capacity. The Council of Central American Universities' Study of Human Resource Needs concludes that the region will require approximately 50,000 people at the business-technician level in the decade 1964-1974.(18) In view of the shortage of middle level

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[18] CSUCA, *Oferta y Demanda Recursos Humanos en Centroamerica*, Costa Rica, 1966, p. 12. We have arrived at this figure by adding the estimate for administrator level 2 (15,679) and office employees level 1, (32,784).

people in the region and the great demand for education in business, it appears that the estimates are reasonable. The same study indicates that the average educational level for middle managers is only 11 years and for office employees class 1, only 10 years. This study confirms other reports that there is a gap between top management and skilled labor, with a general lack of first line managers and qualified staff assistants.

Numerical estimates, useful as they are, tell only part of the story. The demand for management technicians will depend on the availability and the quality of the technicians and also on the recognition of the need for them by prospective employers. As training facilities are set up, graduates will be produced and absorbed over a considerable period of time in numbers to meet the demand for their services. Imbalances in the number and types of technicians produced will be avoided if the training facility is operated in close cooperation with the business community. There must be close coordination of the institute offerings with the community needs for specific managerial skills. In the long run, the demand will be determined by the growth of economic activity of the region and the promotion of the institute among prospective employers.

Business Education and the Universities

In considering the alternative methods of meeting the critical shortage of managerial resources for the Central American region, we have to ask: (1) to what extent is this need being met by the present programs in business administration in existence at every university in Central America; and (2) what is the potential ability and willingness of the universities for providing training at the intermediate level in business.

Each of the five Central American nations has a national university which is autonomous but receives financial support from the government. Nicaragua, El Salvador, and Guatemala have Catholic universities as well. Guatemala has in addition two new universities which have grown rapidly in the past two years.

With regard to the first question, it is our conclusion that the national universities are not producing the quantity or the required quality of business administration graduates. This situation is brought about by a multitude of interrelated factors. First, the universities have served for many decades as the focal point of political turmoil. The students and faculty use the university as a political instrument to gain their particular ends. Since private enterprise is regarded as the cornerstone of the existing system, much of the agitation is directed at the business sector. Many businessmen are suspicious of the politicized students, who have embraced foreign ideology, and consider them unsuitable as prospective employees. There are reasons to believe that the above does not apply to all universities nor even to the majority of students of some universities; but, as we have learned in the U.S., it is the vocal minority that creates a distorted image.

Business managers and educators state that the quality of business training leaves much to be desired. The business administration program is typically a department within the faculty of economic sciences. The program consists of major doses of macro-economics, law, accounting, and statistics. Management courses are downgraded because the traditional theoretical courses have the prestige and, consequently, faculty interest and support. Business graduates call themselves economists because management is not considered a profession.

Whether intentional or not, the business program is at the very bottom when it comes to financial support. There are fewer full-time professors than in other disciplines. Many administrators have complained that qualified faculty is difficult to find. Courses are taught by government officials, lawyers, economists who are in many cases unfamiliar with management technology.

There is no meaningful interaction between the business and the academic community; as a result, business programs do not reflect the management needs of the region.

While some of the faculty have the necessary background, the quality of instruction suffers because of insufficient commitment on the part of the students and faculty, the majority of both holding at least one and in some cases two outside positions. The time for preparation is severely curtailed. Part-time education is also a major factor in the very high dropout rate. Some educators report that since the university is open to anyone with a high school diploma, many students register at a university and keep up their university student status mainly to obtain employment. Many government agencies traditionally give preference to students seeking employment.

Some of the above comments do not apply to all of the universities. The Catholic universities have moved ahead impressively to overcome some of the problems cited above. Although they have encountered staffing problems and are in most cases under-financed, they have made an impressive start in the right direction.

Despite the problems outlined in the above paragraphs, the future of business education is bright. Enrollments in business administration are in many cases higher than in any other professional program. Given the considerable influence that students have in university management, we may expect growing pressure for improvement. The Catholic universities having the needed flexibility are providing a competitive pressure to improve. Furthermore, there are many energetic young faculty members and administrators who are working hard to upgrade the existing programs.

As to the question whether the universities have the capacity or the willingness to offer an intermediate program in management technology, our general conclusion is negative. The Catholic universities and the newer universities in Guatemala have shown tangible interest in technician education, and these merit encouragement and support. The national universities, for the most part, have no physical facilities, teaching staffs, nor any desire to get involved in the practical problems of business. The course content and teaching methods should be different at the technician level, so that business courses as taught at the universities could not be used. The traditional attitude that serving the business community is not a proper function of the university just about eliminates the national university as a logical facility for technician training.

There is a role that the Catholic and the new universities in Guatemala can assume in business technician training. Because of their flexibility, these new universities could establish short-term University Technological Institutes which would prepare technicians not only in business but also in various other needed disciplines. The principal advantage of associating these institutes with a university is in the prestige and status of university education in the Latin American society. A university-associated but independent institute would make a major contribution to the acceptance of the intermediate level professional by prospective entrants, employers, and society in general.

Organization of an Institute

To meet the demand for intermediate level managerial resources, it is proposed that a technological institute be organized.(19) The objectives of the institute (as far as the business training aspects are concerned) should be:

(a) To offer an intermediate level training program for management technicians. The program should be specifically tailored to the needs of the community the institute is located in.

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[19] Where feasible the institute should be associated with a university, and the name would be Instituto Tecnologico Universitario.

(b) To offer training opportunities for business technicians now employed in private and public enterprise.

(c) To design training programs in close cooperation with the business community so that graduates would help the firms meet more effectively the challenges of economic development.

The institute should be integrated into the present structure in such a way as to avoid unnecessary duplication of facilities. The policy-making authority of the institute should be vested in a Board of Trustees which should be made up of representatives of various associations of the private sector (example: Industrial Association, Chamber of Commerce, Agricultural Association, Financial Institutions Assoc.), and representatives of the Ministries of Education, Labor, Trade, Industrial Development, etc. The exact make-up of the Board of Trustees would vary depending on the circumstances in each country. The Board should elect a Dean of the Institute who would act as the executive officer. To be successful, the institute must be a politically acceptable entity. This can best be accomplished if various interests are represented.

For required flexibility the institute should have an experimental status with maximum freedom to innovate new programs as its objectives may require. To do this, the institute must have an independent budget and be otherwise independent and exempt from the traditional authority structure of either the universities or Ministries of Education.

Location

It is recommended that a pilot institute project be established in every major business or industrial center in the region. This would mean one institute in the capital of a number of countries, and perhaps several where greater demand exists, as in the case of Guatemala. While the particular business specialties taught in each institute should vary depending on the economic activity of the country, marketing, production, management, accounting, and finance should form the core of the program in all of them.

Curriculum

The program of studies should be planned in a way which would permit the graduates actually to begin contributing to the effectiveness of the business firm upon completion of the training. The study period should last two years, including time spent working in a business firm. Upon completion of the program, the student would obtain the degree of Technologist in his specialty. The actual class time should be from 15 to 18 hours a week.

Successful completion of the program would require the equivalent of 60 semester credit hours of work. The program should consist of the core curriculum required of every student and would consist of a year (two semesters) of study in each of the functional areas of business as follows:

First Year Program

(1) Marketing
(2) Accounting
(3) Production Management
(4) Business Economics
(5) Organization

The second year program would give the student an opportunity to specialize either in one of the management functions or, depending on the available specialization options, pursue his choice for two semesters. The last semester the student should spend in an actual work situation of his specialty, especially planned and supervised by the faculty. A hypothetical second year program would be as follows:

Second Year Program	1st semester credit hours	2nd semester credit hours
(1) Area of specialization	3	3
(2) Elective (e.g. Personnel Management)	3	3
(3) Business & Society	3	3
(4) Elective (Economic Institutions)	3	3
(5) Business Law	3	–
(6) [illegible]siness Practice	3	–
(7) Financial Management	3	–
(8) Business Practice	–	(Required employment)

The specialization options and electives would depend on the demand at the location of the institute. The programs should be tailored to the needs of the community and planned in close cooperation with potential employers. The above model curriculum provides the student with the necessary training to obtain a job in his specialty as well as to function as an informed participant in the social processes–an understanding of the system in which he is expected to assume responsibility.

In addition to the degree program, the institute should provide specialized certificate programs for which a need has been established in the community. The duration of these programs should depend on the time required to impact the necessary knowledge to enable the trainee to function effectively in his occupation. These programs would be of interest mainly to those who are presently employed.

In line with the objectives of the program and the emphasis on the practical aspects of business knowledge, only a part of the business materials available in Spanish will be useful. The existing text materials will have to be adapted to this level and method of instruction.

Students

According to studies by the Organization of the Central American States, only 10% of those who enter the university graduate. Those who never complete their professional program constitute the vast majority of students who fail to acquire the capabilities to be important contributors to the development process. There is no doubt that compared to dropouts those who acquire managerial skills, which are useful and marketable, serve society to the better advantage. Therefore, despite the general preference on the part of students to obtain a professional degree and become a "doctor," and the vast prestige that such a degree would bring the holder, the technical intermediate degree, properly promoted, should gain the necessary acceptance in the social structure.

In Central America, because students normally marry at a much younger age than in the U.S. the vast majority of undergraduates assume a heavy financial responsibility at an early age. The need to work prevents full-time attendance at the university. To complete a five-year university program often takes 10 or more years. It should come as no surprise that most students never get a degree. Clearly, part-time education is highly inefficient and wasteful of human resources. Some means must be found to enable the proposed technical institutes to attract full-time students and faculty. Because the program is only of a two-year duration, students should be in a better position to devote full time to study, particularly if they know that at the end of the two-year period they will be able to increase their earnings substantially.

The advantages of an intermediate career in business management will have to be promoted among the prospective student population as well as the business community. Once the public understands the importance of the technician to economic progress of the nation, acceptance would surely follow.

Admission Requirements

In Central America there is a long-standing tradition to educate the elite. One of the effects of this approach is that there are many "artificial" barriers in the existing educational system at the higher as well as secondary levels. We call these "barriers" artificial because they do not appear to be serving any purpose other than severely restricting the output of the institutions concerned. The extremely low output of the upper-level educational establishments attests to the effectiveness of the barriers.

The technical manpower needs of a modern society cannot be met by following the present system. Accordingly, the admissions policy of the proposed technological institute should encourage the maximum number of qualified people to take advantage of the educational opportunity. The institute should open doors to the following groups:

(1) High school graduates—academic or vocational

(2) University drop-outs

(3) High school dropouts who have a minimum of two years' experience in some phase of business administration. They would be admitted to an accelerated entrance qualifying program specially designed to enable the student to perform satisfactorily in the institute program.

The admission to the certificate programs should be on the basis of experience in a specific occupation. This admissions policy should salvage a great number of capable young people who have been excluded from educational opportunities and enable them to make an important contribution to the development of their countries.

Faculty Development

The training of qualified professors to teach in the institute programs is vital to the success of the new educational experiment. Recruitment, selection, and the training program should be carefully planned and implemented before the actual teaching begins. Some phases of faculty development could well overlap to save time. An attempt should be made to recruit candidates who are willing to break with the traditional teaching methodology employed in the region.

The following are considered to be ideal characteristics of potential professor candidates to teach in the business program of the institute:

(1) The candidate should have some college work but preferably not a "licenciado" diploma.[20] Two to four years of college is sufficient. It is assumed that the shortage of degree people would make it difficult to retain them after the training period.

(2) The candidates should have some practical experience in the discipline he is going to teach.

(3) The candidates should be given intensive training in the subject they will teach and also be familiar with the main functional topics in business management.

The teaching methods and content should differ from that commonly found at the university. The main emphasis should be to develop the ability to do rather than to know. To the extent possible, student-centered, problem-solving approach should be emphasized in business subjects.

There are at present no facilities in the region to train faculty in the skills we have just outlined. The alternatives for teacher training appear to be as follows:

(1) Set up a regional institute for the specific task of training professors for the entire region. Initially, outsiders would have to staff the facility until local professors are trained.

(2) The Monterey Institute of Technology in Mexico may be considered as a training facility.

(3) Selected candidates might be sent to the U S. for a specified period. The language barrier and the high cost present some disadvantages.

There are both undergraduate and graduate p[illegible]s in the region. The approach in a typical undergraduate school is too theoretical, while INCAE orientation is at a different level and would not be appropriate for the institute faculty.

The regional faculty development institute appears to be the most advantageous alternative. The institute could also prepare teaching materials for all technical institutes of the region. It might also experiment with new teaching methods.

Technical Assistance Needed

Since there is no intermediate education in business in the region, successful organization of a program of training would require a certain amount of outside assistance. Such assistance should be in the form of technical advisors with the final authority remaining with the officials of the host country. The presence of outside technicians should be temporary until such time as local educators can be trained to assume the various responsibilities related to successful implementation. To be a success, the proposed institute should be a project of the host country which should make the major commitment in terms of human resources, physical facilities, and operating costs. Unless the business community and other interested groups recognize the need for technician level training, the project will have difficulty in attaining its objectives.

Building a new educational institution is essentially a long-term project and outside technical assistance will be necessary for at least three years. The exact number of outside consultants would depend on the functions they would need to perform. It appears reasonable that at least one technician for each of the major management functions would be required. While these would be useful and desirable at every institute, the possibility of using one set of consultants for the entire Central American region should be explored. A third alternative would be to assign one outside consultant to each institute. The program should be conceptually similar in all five countries of Central America, and it would be logical for one of the regional agencies, such as ODECA, to sponsor and assist with the coordination of the related activities.

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[20] University degree

Mature, bilingual, and experienced consultants should be recruited to provide consulting in the following:

(1) Organization and planning of the institute

(2) Faculty training

(3) Curriculum development

(4) Planning a library

(5) Teach in the professor-training program

IMPLEMENTATION STRATEGY AT EACH LOCATION

Costa Rica

The education level of the Costa Rican work force is well above the rest of the region. Of the total employment in 1967, 4.4% had some university education, 11.4% had secondary education, 71.4% had primary education, and only 12.8% were illiterate.(21) During the last decade the educational system has expanded rapidly at all levels. There is only one national university, where enrollments have been growing at about 11% to 12% per year during the last ten years.(22) Total student population has increased from 2,474 in 1957 to approximately 12,000 in 1970. The Department of Business Administration has until very recently consisted mainly of offerings in Accounting. The program in management has been expanded, but courses have been dormant mainly due to lack of financial support and qualified professors to teach. There are 116 students per professor, the highest of any department at the university. The Department is operating under conditions of critical shortages of faculty, physical facilities, and operating funds. The quality of the program reflects the operating conditions. Aside from the Accounting program, which appears to be adequate, the other functional areas are largely on paper or in planning. Despite the weaknesses, the interest of the student population in business administration is very high. There are 750 students in the Department, representing 70% of all students within the School of Economics and Social Sciences.

At the moment there are some 150 students in the 5th and last year of the program. All of these are in Accounting. However, only 40 to 50 students complete their studies each year, and only about 10 of those who complete their studies obtain a degree each year.(23)

The Escola Superior de Sciencias Contables is another post secondary facility for training accountants. It has an enrollment of about 500 and enjoys a good reputation in the community. In addition, there are about 20 private "business" schools in the city with a total student population estimated to be in the thousands. Many of these claim that they are preparing students for administrative positions. In fact, in most cases the student gets very little in return for the high tuition fees and the great deal of time and effort spent attending these schools, even though they are led to believe that they are working in a *bona fide* program. Only about two of the twenty schools should merit a satisfactory rating, and these prepare primarily bookkeeping and clerical personnel.

The recently founded private Instituto Tecnico de Administracion de Negocios offers a three-year program in business management. It is a night program which is working under severe financial handicaps, and there is some uncertainty as to its future.

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[21] *Planificacion de los Recursos Humanos en Costa Rica*, Ministerio de Trabajo y Bienestar Social, San Jose, 1969 p. 25.

[22] *Ibid.*, p. 47.

[23] To obtain the Licenciado Diploma the student must pass a public examination and also write a thesis, a practice common to all universities in the region.

Our review of the existing facilities for training in business management indicates that only in accounting is there sufficient capacity to produce the required technicians. Our interviews with managers, educators, and government officials in Costa Rica indicate that there is an urgent need for well prepared technicians to deal with the practical problems of business management in the region.

A recent human resource study reports that of the 11,046 managers and administrative workers in Costa Rica, nearly one quarter have only primary education. The figures are as follows:(24)

No. with university education	2,430
No. with secondary education	1,834
No. with incomplete secondary education	2,121
No. with primary education	2,317

The same study estimates that 1,759 additional management technicians will be needed between 1968 and 1972.(25) The estimate appears conservative in view of the developments in the economic environment. Among the most important of these new trends in Costa Rica is the rapid population growth (over 4% per year), and urbanization. Another trend is the change in the operation of the family enterprise which is still the dominant form of business. Many of these are outgrowing the scale of operation which could be managed by the immediate family. Particularly at the first and middle levels of operating management there is a critical shortage of managerial personnel.

Even though Costa Rica has the best educated work force in the region, its educational system is not now producing the technically trained manpower needed for its further economic progress. To overcome this manpower deficiency, we recommend that a program to train intermediate-level technicians be initiated without delay. If the currently pending legislation authorizing the establishment of the Instituto Tecnologico de Costa Rica is approved, it would be logical that the proposed program become part of the new institute.

Nicaragua

Nicaragua is a small country where traditionally agriculture provided most of the employment and income. In recent years, the role of agriculture has been declining and considerable emphasis has been placed on the development of industry. With a few exceptions, the small family-owned firm is still the dominant type of productive unit. The potential expansion brought about by the regional common market and the increased emphasis on industrialization may be expected to lead to larger business establishments of all types.

The growth in economic activity is expected to increase the demand for middle-level technicians in business. Businessmen typically stated that it was easy to find a professional but impossible to find a foreman, production planner, or plant manager. In many cases, inexperienced people are given important managerial responsibility. It is an expensive method to train people, but often the only method available.

At least three studies of demand for human resources in Nicaragua have been made in recent years.(26) These were conducted by: (1) the UNESCO mission with the cooperation of the National University of Nicaragua; (2) The Office of Human Resources of CSUCA; (3) The National Planning

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[24] *Ibid.*, Part II, p. 103

[25] *Ibid.*, p. 107

[26] See *Demand for Human Resources*, in *Plan de Desarrollo.*

Office. All used the basic data provided by the National Statistics and Census Office.(27) The projection of needs was based on the National Development Plan of Nicaragua. The demand for university-trained professionals in business management is variously estimated from 120 to 250 per year. The only available estimates for the intermediate technical level in business were for public accountants (about 40 per year), and computer programmers (20 per year).

The occupational role of a middle-level business technician is not established or well understood in Nicaragua or elsewhere in the region; therefore, most human resource demand estimates fail to make projections for these occupations.

The experience of the Polytechnic and the National University short-program graduates is the best indicator of demand. In both cases the demand far exceeds the present or future supply.

Existing Management Training Facilities

As in other Central American universities, the business administration program is at the National University of Nicaragua (UNA), within the School of Economic Sciences (Facultad de Sciencia de Economicas), which has a current enrollment of about 850 students, with about 300 in the Business Administration Department. The enrollment figures tend to provide an exaggerated picture when these are compared with the number who actually complete the program. The Business Administration program, which started in 1959, has produced only about 75 persons (15 graduates and 60 who completed the course work but have not taken the public examination or written a thesis). A new law allows two years to complete the thesis and take the examination, otherwise the student would have to repeat 50% of the courses. One of the demands of the August, 1970, student strike was that the 3-hour public examination be eliminated. There is also a new program in Accounting with a current enrollment of slightly under 100 students. One factor which limits interest or student demand is that the accounting profession in Nicaragua as in the rest of the region has traditionally required only a secondary-level education.

UNA Intermediate Program in Business

The short course programs are given by the Research and Development Institute at UNA (Instituto de Investigaciones al Desarrollo). Students who complete the intermediate program can move into the regular program without loss of credit. The Institute also makes studies for private and public organizations. The fees from this activity provide money and experience to students who work at the Institute. Part of this money is used to finance the two "short" programs. Intermediate graduates get a title of Marketing Executive or Sales Technician. Some thought has been given to starting a program in import-export management. Dr. Tunamen, the rector of UNA, is reportedly interested in intermediate programs. However, there is some question whether or not the students would allow an Institute to operate.

The Central American University–(UCA)

This relatively new Catholic university has experienced a phenomenal growth in its business administration program. Enrollment jumped from 900 in 1969 to 1300 in 1970 (100 of these are in Accounting). Some 20% of the students are in the day program, and this is expected to grow rapidly. In 1969, 74 students completed their work, and 49 of these graduated. As elsewhere, the dropout rate is extremely high and amounts to 51% of the first-year students in administration. The dropout rates for second, third, and fourth year range from 15 to 31%, with the result that graduating numbers are quite modest when compared to the entrance figures.(28)

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[27] Direccion General de Estadistica Y Censos.

[28] *Datos Estadisticos del Curso*, UCA, August, 1969.

Some of UCA graduates in business have encountered difficulty in finding jobs. This in in part due to their reluctance to start at the bottom. Employers claim that in Nicaragua the university graduates expect to start at the top.

Normal student class load is 20 hours a week, but attendance is only a little above the 50% level for the night program and close to 70% for the day program. Only 3 professors are full time, and their teaching load ranges between 14 and 24 hours a week. The balance of the faculty are contracted by the hour and paid N$40. per class hour. While the full-time *catedratico* gets up to N$60,000. per year.

The students in the degree programs are predominantly of middle class and upper lower class background, many of whom find it necessary to work either full or part time. The school originally started as a night school. Even now only 20% of the total enrollment is in the day program which takes 4½ years to complete presuming the student does not deviate from the schedule. The night degree program requires 5½ years to complete. The University is pressuring students to switch to the day program because at night the facilities are used to full capacity.

The Polytechnic Institute of Nicaragua

The Polytecnic Institute of Nicaragua offers a two-year program in business administration. In 1969 out of the 102 in the first graduating class, 67 were business majors. More than 25% of the enrollment is in the business program. In view of the extremely limited financial resources, the Institute has made excellent progress in its three years of operation. Graduates are able to transfer to the other two universities with the loss of only one year of credits. The Institute also offers short seminars in Business Management. All of the professors teach and get paid by the hour. About 90% of the students have full-time jobs working 6 to 8 hours per day. As a result, most find it difficult to keep up with their classes which run from 6:45 to 9:45 five days a week. The dropout rate is very high. The motivation of students is high as indicated by their willingness to study after work and pay tuition out of their very low salaries.

INCAE(29) has a Masters level course in Business and also provides short seminars for top executives. It is a unique regional institution in that its support comes primarily from the private sector. The School, organized with technical assistance of the Harvard Business School, has made a significant contribution to the acceptance of business administration as a subject worthy of study at the university level. We might expect that INCAE graduates would have a favorable attitude toward the value of management knowledge and be receptive to the employment of business graduates in their firms. Many of the top managers interviewed stated that they could not leave their business to attend INCAE programs. In many situations observed, this was literally true. There is no one between the manager and the workers. In one case, the manager-owner of one factory had to call his brother to take over every time he took a vacation or a business trip.

Industry Placement

In contrast to the intermediate program students who have jobs during and after their schooling, regular degree program graduates have some difficulty in finding jobs.(30) This situation is explained as being due to the fact that, for the most part, those who are presently employed in administration have only practical knowledge and little appreciation of formal business education. Many of the owners apparently do not quite know how to use the business graduate. The situation

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[29] Instituto Centroamericano de Administracion de Empresas

[30] Graduates in technical fields have even greater difficulty in placement.

is rapidly changing because (1) it is now difficult to find a medium or large business organization which does not have one or more business school graduates, (2) the businessmen are more receptive to new ideas, and (3) increasing competition is forcing managers to modernize their companies.

Short Programs for Business Employees

The UNA has two programs at the intermediate level: the Sales Technician program of 2 years duration, requires secondary school completion or five years' experience; and Sales Management, which requires 3 years to complete. The programs are offered at night including some work on Saturdays and Sundays. The courses enjoy considerable popularity, the enrollment fluctuates between 400 and 500 students. The students are highly motivated as indicated by their willingness to commute great distances and go to school on weekends. (Saturday schedule 1-6 p.m., Sunday 8-12 a.m.). The attendance is much better than in the regular university classes. The tuition costs are triple (N$150. cordobas) those in the regular program. The payoff to those who complete the program is rapid advancement at work. The professors in this intermediate program are the same men who teach in the regular degree program. Also, some of the basic courses are common to both the degree and intermediate programs. There is a lot of demand for other short career programs, but the university has no present plans to initiate new programs because of lack of resources.

The Productivity Center of the Nicaragua Chamber of Industries started to offer short-term management development type courses of 30-hour duration in various topics of business. In the past one and a half years some 350 people have taken part in this program, and the demand is growing. Typically, the business firm pays the costs of the program for its employees. The Chamber of Commerce has a program to train sales people and sales supervisors.

Recommendation to Strengthen Business-Training Programs

Our review of existing facilities for business training indicates that while limited opportunities for middle-level business education exists, these are without exception not producing the required quality, kind, or sufficient quantity of people. Nevertheless, an attempt should be made to avoid the duplication of facilities. The possibilities of strengthening the present programs should be explored. The major improvements needed are as follows:

(1) Faculty should be trained.

(2) Curricula should be changed to reflect the needs of business firms in the communities.

(3) The business community should be involved in the planning and policy functions of the educational institution.

In short, the existing programs should be redesigned according to the basic model presented in the early part of this report. The Politechnic Institute leaders appear to be ready to make the required changes. But without public financial support and outside technical assistance, along the lines recommended in this report, the required management-training programs will not become a reality.

EL SALVADOR

Current National Plan for Education in Business Administration

The Ministry of Education is planning to establish intermediate technician education programs in various disciplines, including business administration. The programs will be of two or three years' duration and will be housed in the new comprehensive high schools now under construction. The two-year post secondary intermediate education institute is referred to as the second stage of educational reform which is now under way at the primary and secondary level. The institute will offer technician options only; no academic program will be available. The Ministry has also adopted the concept that teachers should be trained outside of the country, since local facilities are not available. INCAE in Nicaragua is being considered as the center for training business administration teachers for the institute.

Existing Business Education Facilities

Business management, as a profession, is a new concept in El Salvador. Several years ago the National Census estimated that there were only half a dozen university graduates with degrees in business administration, and these were apparently obtained outside of the country. In 1967, the University of Canas started operations. Of the total current enrollment of 1343 students, some 554 are in business administration. The first graduating class next year is expected to include about 50 business administration students who will complete their studies. The vast majority of the students are on a part-time basis. Under the best of circumstances working full time and carrying a full academic program seriously jeopardizes the quality of education. Local business and government leaders criticize the university programs because they teach theory to the exclusion of practice. Another frequently heard comment is that the local National University is to a great extent alienated from the economic organizations of the country. According to the local business managers, the students are thoroughly politicized so that a considerable number are actually anti-business and at least some firms have been reluctant to hire the graduates.(31)

As a result of the prevailing conditions at the National University some students interested in a business management career have shifted to the new Canas University, where the business administration program has experienced phenomenal growth. The National University business majors number less than 200, or less than one half of the Canas University majors.

Despite the traditional business management patterns which are in evidence, there are signs that professional management is on the rise. According to one source, there are 50 to 75 young managers who have completed their higher education abroad and who now have top management positions with the larger commercial and industrial firms. Even though their education has been technical, in many if not most cases, they have attitudes which are favorable to professional management.

Short-term management development activity is concentrated primarily in the government-sponsored Productivity Center and the Association of Private Business Managers, with each sponsoring some half a dozen programs each year.

Intermediate Business Education Needs

A comprehensive study of manpower needs implicit in the five years' sectoral plans of the National Economic Planning Council is scheduled to begin in October, 1970. The findings of this study should serve as a valuable guide in determining the needs in each category of business specialists. On the other hand, in view of the state of development of the intermediate-level technician in administration in El Salvador and elsewhere, no manpower study can be expected to be definitive.

Without exception, the business community leaders interviewed agreed that there is an urgent need in El Salvador to train intermediate technicians in business for the future and to upgrade the

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[31] A professor commented that politization is brought about by the Economics faculty.

personnel currently engaged in business administration at this level. The limiting factor to further growth in the industrial and the commercial sector appears to be the lack of qualified lower level line and staff specialists. Salvador does not have idle arable land, as some of its neighbors have, and therefore must rely on industry to provide for the growing needs of its people. Industrial expansion in the past decade has been considerable and tends to confirm the often noted comment that local industry is capable of expansion and growth despite increasing competition within the Central American region.

It is suggested that an intermediate management education program be initiated for recent secondary school graduates, the many university dropouts, as well as those who are now employed in various business occupations who need upgrading. The current plan of the Ministry of Education to use the newly constructed high school facilities for this purpose has the advantage of minimizing initial capital outlays. The addition of the business curriculum to the technical program at Sta. Tecla Technical Institute as well as sponsoring an intermediate-level program at the University of Canas, are other alternatives which should be explored.

As in the other countries of Central America, the demand for business technicians will ultimately be determined by the need for people with these capabilities and the recognition of this need on the part of practicing managers. In view of the scale of economic activity, our estimate is that Salvadorean firms would easily absorb 200 to 300 newly trained business technicians by 1974, when the first group should be completing its studies. In the meantime, there is an urgent need to train those who are currently employed at the technician level in business. The accelerated program for business employees should be offered concurrently with the regular program. The business community as well as top government leaders in El Salvador recognize the great need for technician-level manpower in business administration as a prerequisite to economic progress. Providing that appropriate policies (along the guidelines outlined in this report) are adopted, the prospects of human-resource development in this key area are excellent.

HONDURAS

Honduran economic activity has traditionally centered around agriculture. In recent years, significant changes have been taking place in all sectors of economic activity. In industry there has been a trend from importing to manufacturing. The origin of the entrepreneurship has come primarily from the well-established families in commercial activities, with some important contribution from foreign investors, including Central American interests.

Many Hondurans feel that industry and commerce is in the hands of second generation immigrants from the Middle East. This may be an exaggeration, but it is true that they have been the major driving force behind the economic progress.

Some of the general characteristics of underdevelopment encountered in the region are more pronounced in Honduras. The country is less developed, the per capita income is lower, the infrastructure is less developed, and there are fewer qualified management technicians than in the neighboring countries. There are many factors responsible for the present situation. Certainly the change in economic leadership from the Germans, who had their assets confiscated in World War II, to Middle Easterners, may have slowed the progress, since a new set of managers had to learn the business functions. The protection from competition, relative isolation, and the small local markets did nothing to stimulate development of managerial talent.

The situation changed rather suddenly with the establishment of the regional common market. Suddenly the Honduran economy was confronted with challenges of the modern world. Its backwardness became only too apparent when it was forced to compete with its more advanced neighbors. The critical shortage of management technicians and know-how in general is felt not only by the traditional family-type business establishments but also by the various new projects now under way or in planning. In nearly every case, the investors have had to bring in the top managers from the outside. It was reported that it would not be economic to import technician-level managers because of the numbers required and the relatively high cost to the new enterprise.

The findings of our interviews with regard to the shortage of technician-level people in business is supported by a recent survey of Honduran business firms by the CCTI.(32) The firms completing the questionnaire report that they need 374 people in the business management functions. Business managers were unanimous in reporting that first-line and middle-level people are impossible to find.

Business, government, and educators are concerned about the lack of managerial talent, but with the exception of the CCTI program for business employees, nothing is being done to improve the situation. The government looks to the commercial programs at the new diversified high schools to prepare business technicians. Even if the above program is put in effect, at best it will only provide clerical personnel.

The CCTI provides short-term courses of 20, 30, or 40 hours of instruction in various aspects of management. Probably most of these are too short to provide sufficient technical competence but undoubtedly stimulate interest in management knowledge. Since most of the participants are from the ranks of middle, lower, and staff assistants they have encountered some difficulty in putting the newly acquired knowledge to work because their superiors do not understand how these new concepts can benefit the business. During the past decade, CCTI has given some 400 courses to 9000 participants.

There is only one national university in the country. The Department of Business Administration is part of the School of Economics. It is a new program, with an enrollment of 160 students and another 74 in the Accounting program. The first graduating class this year numbers only five people. The lack of faculty, part-time schedules, low class attendance (about 35%), non-rigorous work, and rare academic failure, cause managers to be less than satisfied with this source of management personnel. Even so, the demand for graduates is high.

In view of the existing manpower requirements of the various sectors of the economy an autonomous institute for the training of technicians should be established at the earliest possible date. The general program should be patterned after the regional model we have suggested in the early part of the report. Initially, the main campus should be established in Tegucigalpa, but as soon as this is operational, a branch will be needed in the industrial center of San Pedro Sula.

GUATEMALA

The Demand for Intermediate-Level Technicians in Management

Guatemala is considerably larger than the other Central American countries, both as to population and scale of business activity. Mainly because of the economic progress experienced in recent years and current development plans, the shortage of middle-level managerial resources is more critical than for the other parts of the region. Some business leaders and educators have voiced fears that this shortage of manpower is slowing the development of the country. A human-resource study estimates that the existing higher-education institutions should prepare some 500 intermediate-level technicians per year, and the actual deficit for technicians will be about 1300 per year.(33) Another study estimates that 15,000 managers should be trained in the period 1968-1974, or 1550 per year.(34) At the present time only a small fraction of the required number are being trained at either the university or intermediate level. There is a great discrepancy between the required managerial resources and the ability of existing institutions to satisfy the demand. Furthermore, the present efforts to train management technicians are inadequate as to both the quantity and the quality produced.

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(32) Centro Cooperativo Technico Industrial

Whatever deficiencies, in quality the graduates as yet have encountered no difficulty in finding employment. But the number of graduates has been very small, and there is a sellers' market at this time. The educational level of present managers is rather low at this time, and a major upgrading effort will be necessary.

FORMAL EDUCATION LEVEL OF MANAGERS
(in thousands)

	Total	University	Secondary	Primary	Other
Number of managers	8.1	1.5	1.5	2.4	2.4
%	100%	18.6%	22.2%	29.6%	29.6%

Source: *Plan de Desarollo Integral De La Educacion Superior*, Guatemala, Agosto, 1968, p. 68.

Even though the data is out of date, it does indicate a high proportion of managers with little or no formal education. Many of these are undoubtedly self-made men who are managing small-scale units. Still, as recently as 1966, there were only 3 business administration graduates in Guatemala. At the same time, there were 83 professional accountants and 61 economists.(35)

Existing Business-Training Facilities

Undergraduate professional programs of business administration exist at the universities of San Carlos, Landivar, and Mario Galves. None of these can be termed as adequate, because of some of the commonly encountered problems in this region which have been discussed in the early part of this report. But, according to one informed educator, some of the programs are worse than others. The Landivar and Mario Galves programs in business are relatively small, about 40 and 60 students respectively. The largest enrollment in business is at the National University of San Carlos, with some 800 students, but less than a dozen are expected to graduate this year. There are those who would argue that a poor program is better than no program at all. The present writer does not share this view. In the first place, the "paper" programs give the illusion that capacity exists and that some progress is being made to meet a critical human-resource shortage. Second, early disappointment with the quality of the product on the part of business managers will ruin the market for future business graduates. And finally, it is wasteful of students' time. The students and society have a right to better training.

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[33] *Plan Academico, 1974*, Universidad de San Carlos, 1968, p. D2. See Appendix N.

[34] *Plan de Desarrollo Integral De La Educacion Superior*, Guatemala, 1968, p. 69.

[35] *Ibid.*, p. 83.

There are many dedicated young educators with excellent education who know the shortcomings of the present programs. Much has been written about the shortage of manpower for development and the need for a university to be relevant. The new universities have the flexibility and are, for the most part, willing to modernize, but do not have the resources. Attempts to change the older institutions have not fared well.

Adult education programs for practicing business management employees is, at present, concentrated at the National Center for Development, Training, and Productivity, an autonomous public institution.(36) A great variety of short-term courses are offered. Three to four thousand managers participate in these programs each year. The programs are self-supporting, with the employer typically covering the tuition costs of his employees. The training programs appear well planned and executed. Undoubtedly, they will lead to the improvement of management practice. They are neither intended nor should they be expected to provide training for young people interested in middle-level business careers.

A Proposal for a Middle-Level Training Program in Management

It is recommended that a program be initiated in the near future to narrow the gap between the demand and supply of middle-level management resources. An institute patterned after the model discussed at the beginning of this report should be set up as a cooperative effort between CENDAP and one of the new universities. While the main emphasis of a new middle-level institute should be to produce the required quality and quantity of middle-level business technicians, an attempt should also be made to aid the present middle-level programs at Mariano Galves and Landivar Universities. While a first-class institute program would put some pressure on existing programs to improve, it would be desirable to provide technical assistance in the form of curriculum development, professor training, and teaching materials to other institutions interested in training middle-level technicians.

There is some concern that the institute graduates will assume the positions of professionals in management, and business will continue to operate without the benefit of qualified operating level personnel. It is conceded that this may well happen initially during the shortage period. As the demand is satisfied, this tendency will eventually be overcome.

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[36] Centro Nacional de Desarrollo Adiestramiento y Productividade (CENDAP).

CENTRAL AMERICA

COSTA RICA–EL SALVADOR–GUATEMALA–HONDURAS–NICARAGUA

Mid-Level Technicians for Engineering

by Robert E. McChord

General Summary of Recommendations and Conclusions

1. *An engineering technician manpower requirements study (survey) in all countries is urgently needed.*

2. *There is no apparent need for great numbers of engineering technicians at this time.*

3. *Because of the type of industry, highly sophisticated training in science and engineering design is not presently needed in local industry.*

4. *The type of technician that seems to be needed most is the industrial engineering technician who can move into middle management.*

5. *Other types of technicians needed but in lesser numbers are: maintenance technicians, production technicians (methods and time study, plant layout, quality control), electrical and electronics, drafting and design, construction, surveying, chemical, electro-mechanical. The need for these latter technicians should be carefully determined on a community, national or regional basis. Without indications of specific needs in quantity from industry and government, these latter programs should not be started, unless in selected institutes where they would service the entire country or region.*

6. *Technical Institutes must produce the type of technician that industry needs and wants.*

7. *Industries must be educated as to what a technician is and what he can do for them.*

8. *There is a need for a national placement organization to match jobs available with talent available.*

9. *Central American and other Latin American graduate engineers with industrial experience should be employed as teachers in technical institutes.*

10. *Those engineers entering technical institute education must, in some way, be indoctrinated in and imbued with the technical institute philosophy.*

11. *Efforts should be made to employ full-time teaching staff rather than part-time and hourly.*

12. *Technical institutes should have industrial advisory committees to assist in curriculum development and revision.*

13. *To make available advanced education for technical institute graduates, consideration should be given to establishing a four-year Bachelor of Engineering Technology Program.*

14. *A system of national or regional accreditation is needed for both public and private technical institutes.*

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15. *Follow-up surveys of graduates should be periodically made to determine the relevance of their education to their jobs.*

16. *Standard terminology for the names of the institutes, a generic title to describe the curriculum, and an appropriate title for the graduates should be established.*

17. *Realistic admission standards should be set.*

18. *A good counseling system must be developed to support the student.*

19. *Students should learn to read English, to assist in their technical education now and in the future.*

20. *A national educational program is needed to change the attitude that everyone should strive only for a university education.*

21. *It is apparent that each country cannot economically support its own technical institute with a full program of engineering technology studies. It is recommended that a solid and economical program of establishing technical institutes or junior colleges be worked out with ODECA*(37) *and ROCAP.*(38)

22. *At the present time all countries could well cooperate and take advantage of the Central American Technical Institute in El Salvador.*

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[37] Organization of Central American States.

[38] Regional Office, Central America and Panama, U.S. Agency for International Development.

CENTRAL AMERICA

COSTA RICA–EL SALVADOR–GUATEMALA–HONDURAS–NICARAGUA

Engineering Technician Education

Prologue

"It is not necessarily true that education stands at or leads the forefront of development of a country; on the contrary, the education system develops as general development occurs, and that changes in education follow rather than proceed changes in society."

Central Americans are aware of the need to upgrade and develop their systems of secondary and post-secondary education to meet the changing needs of a developing country.

This portion of the report is limited to a study of the needs of industrial and engineering technology education requiring a minimum of two years post-secondary education.

The following definitions were used:

Engineering Technology: Engineering Technology is the part of the technological field which requires the application of scientific and engineering knowledge and methods combined with technical skills in support of engineering activities. It is in the occupational spectrum between the craftsman and the engineer which is closest to the engineer.

Industrial Technology: The graduates work in the technological field between business management and engineering as well as between management and crafts. The work is related to the applied aspects of industrial processes, technical sales and management with strong orientation toward people so that the technologist might find a position such as shop foreman, technical sales representative, or a coordinator to improve relationships between people or materials and machines in the production and distribution of industrial products.

According to the mission assignment, the most relevant activities of the Central American universities were their "short careers" programs. The term "short careers" leaves something to be desired, but nevertheless, it is used and understood.

Most of these courses did not meet the training needs of technicians as they are described above. They reflected the first two years of the professional programs and did not lead to career entry jobs.

Industry

The technical manpower needs of industry in Central America are very hard to determine because of lack of studies and the fact that hearsay reports tend to be exaggerated.

A manpower requirements study for both engineers and engineering technicians should be undertaken.

Industry is not currently making demands for professionals or para-professionals with the few exceptions of some very large companies anxious to build their junior executive ranks.

In discussion with industrial leaders, the shortages seem to exist in business management and industrial engineering. In addition to these, there are needs that the managers apparently did not seem to recognize, such as: accountants, maintenance technicians, methods and time study, plant layout, production technicians and quality control technicians.

The type of industry that is developing in Central America should be the determining factor in the type of technician needed.

The trend seems to be that the know-how of technology is imported and that technical needs are then reduced to maintenance and production. Therefore the highly sophisticated training in science and engineering design is not presently needed in local industry.

In reading reports and making plant visits, it is apparent that most industry consists of assembly, parts manufacture, food and mineral processing. In most cases, the research, development, design and production of machines, dies and jigs is imported from other countries.

From this, we can make a more accurate determination of technician needs.

Since industry is not seeking more professionals at this time, and since many already employed are performing technician tasks, where do we go from here?

Demands for Technicians

Without exception everyone in government and industry that we talked with indicated a need for technician training at the university level; however, they had no clear picture of the type of training that was needed.

In addition the industrial growth charts shown elsewhere in this report indicate good growth during the last ten years and the growth rate is expected to continue.

Therefore, projections for five and ten years from now are as important as determination of present needs for technicians, both as to their numbers and desired qualifications.

Other factors to be considered are the national needs for technicians as well as the needs of the community where a university institute is located.

It is significant that most of the technicians we observed in industry were placed in foreman and middle management positions regardless of their academic training. We observed very few performing technical tasks for which they were prepared.

In general it appears that industry needs foremen and middle management with technical backgrounds and some management training.

This suggests that an industrial engineering technician is needed who is trained in several specialties and possible options to meet local needs.

Along with courses in management and the humanities, specialty programs are needed in methods and time study, plant layout, quality control, material control and scheduling, technical purchasing, statistical analysis and production management.

Other but lesser needs are for graduates of the standard technical programs in electrical and electronics engineering technology, drafting and design engineering technology, construction technology, surveying technology, chemical engineering technology and general engineering technology (electro-mechanical). The need for these technicians should be carefully determined on a community and national basis. Without indications of specific needs in quantity from industry and government, these programs should not be started, or at best, in selected institutes where they would service the entire country.

Placement Potential

As indicated in the previous section, except for middle management, there is no apparent large scale demand for engineering technicians at this time. However, as could be expected in a developing and expanding economy, some managers are not aware of their technician needs.

Placement has three facets:

1. Technical institutes must produce for the needs of industry.
2. Industry must be educated as to what is a technician.
3. A national placement organization is needed to match jobs and available talent anywhere in the country. This means that people with special talents and training must be encouraged to be mobile.

Organizational Structure

The problem in Central America is under which organizational structure should technical institutes or junior colleges be organized.

Organizational Possibilities

Technical institutes may

1. Operate in conjunction with existing universities and university polytecnics.
2. Be an independent educational institute under either national and/or department sponsorship.
3. Be joined with university institutes (junior colleges).
4. Be private non-profit organizations.
5. Under certain circumstances, be multidisciplinary in nature, including university transfer, business curriculum, medical curriculum, agricultural curriculum, etc.

All over the world, technical institutes have been developed under all of these systems. The advantages and disadvantages of each is well known; however, certain general problems must be avoided:

A technical institute must have a director and an independent budget that cannot be eroded by other organizations

It must serve the community and nation.

It must not unnecessarily duplicate available services.

It must be properly staffed.

It must have access to proper laboratories (shared when feasible).

It must be properly financed.

It must be properly housed.

It must have the support of the community, industry and government.

More detailed discussion of the above will be covered later.

Faculty

In any new field of education, such as engineering technician education, the recruitment of qualified faculty becomes a problem.

In other countries that have engineering technician training at the university level, the faculty is recruited from the ranks of the graduate engineers, usually at the BS or MS level with three to five years of industrial experience.

NOTE: *Vocational arts teachers are not prepared to teach engineering subject matter and should not be hired to teach technical-engineering portions of the curriculum.*

A great deal has been said about the engineering graduate being too theoretical and not oriented toward laboratory experiments. This may be true for some but certainly not for all. Therefore, it is recommended that Central American and other Latin American engineers with industrial experience be employed as teachers in technical institutes.

As stated before, many engineers are presently performing technician's tasks. Thus by working with their hands on equipment they appreciate the function that the technician can perform.

Since many engineers have to find employment in other than engineering work or leave the country, it follows that recruitment might not be too difficult, especially if the salary and working conditions are attractive and proper recognition, such as academic rank, is given.

It is axiomatic that to be a good technical institute teacher, you have to have the technical institute philosophy.

This can be accomplished through:

1. In-service training programs where objectives, philosophy and teaching techniques of the technical institute movement are studied and discussed.

2. Visits to other technical institutes at home and abroad with objectives as above.

3. Sending new instructors to institutes specializing in training technical institute instructors. Programs may vary from three to 12 months. An example is The Pennsylvania State University's one-year institute leading to a master's degree in engineering or education for those planning to teach in technical institutes. (The University of Illinois also has a master's and bachelor's program.)

4. Bringing in a specialist in technical institute education for consultation and training of the entire staff of a new institution. This consultation could consist of one month to one year, depending on what is required of the consultant by the institution.

An effort should be made to shift technical institute teachers to full-time employees of the institute rather than using part-time and hourly employees. Full-time staff will take more of an interest in the development of the institute, development of curriculum, student counseling, liaison with industry and recruitment of students. In addition, it takes a full-time staff to write text books and develop laboratories.

Curriculum

Suggested curricula in all specialties are readily available and can be easily adapted to local and national needs. The important need is for a technician manpower study to determine what curricula are needed and where.

An excellent source for information on curricula, text books and laboratory equipment, including space requirements, is available from

United States Office of Education
Bureau of Adult, Vocational and Technical Education
Division of Vocational and Technical Education
Washington, D.C. 20202 USA

It is not expected that these outlines would be used verbatim, but rather modified to meet local and national needs.[39]

Consideration must be given to pre-technical institute education courses that will enable students with high aptitude to satisfy entrance requirements to their chosen curriculum.

Items to be considered during curriculum development:

1. *Advisory committee and surveys.* Involve the consumer of your product, namely, industry. This can be accomplished through surveys and an industry-government advisory committee.

2. *Transfer of credits.* Technician education has a different objective than engineering education and the result is that credits are not directly transferable into an engineering curriculum because the courses are not the same. Transferability is an important aspect of curriculum development and student acceptance. The theory is that any student should be able to pursue an education as far as his abilities will take him.

To achieve this purpose, arrangements should be made in advance with engineering colleges for as much transferability of credits as possible, including possible make-up courses and special programs. Another alternative now prevalent in the United States is the development of a new degree leading to a B.S. in Engineering Technology. This is a four-year applied engineering degree as opposed to the present theoretical degree. The last two years are based on the first two years of the technical institute program, which makes full transferability of credits possible. The emphasis of the last two years is generally on design or management.

3. *Equipment.* Much is heard and written about the need for massive amounts of equipment and expensively-outfitted laboratories. It is true that good laboratories are needed, but they need not be expensive or overequipped. The purpose of the labs is to demonstrate principles and to give some hands-on experience with certain types of equipment. Some equipment can be of the miniaturized type rather than full scale; the student learns the same principles at less cost. Do not buy equipment (no matter how attractive) if its use is not built into the course outline and curriculum. Although many schools and universities which we visited complained of lack of laboratory equipment, it became obvious that many of the laboratories could be developed by the instructor by building the equipment himself or by having it donated by industry and government. By tradition, since the training of the instructor does not include the use of laboratories, he finds it difficult to accept responsibility for developing laboratories himself, even though he knows he should have them. The moral: try to change the attitude of those responsible for laboratory instruction.

4. *Accreditation.* Respectable minimum standards for curricula are needed to maintain the reputation of technical institutes for providing a quality education. A system of curriculum accreditation is needed for both public and private schools.

Preferably, the accreditation should be conducted by an independent body. In the United States this is performed by ECPD (Engineers' Council for Professional Development), 345 East

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[39] See Appendix C for a list of these publications.

47th Street, New York, New York 10017. ECPD is a consortium of the major engineering societies, such as The American Society of Mechanical Engineers, American Society of Civil Engineers, The Institute of Electrical and Electronics Engineers, Inc., American Institute of Industrial Engineers, American Institute of Chemical Engineers, American Institute of Aeronautics and Astronautics, Inc., and others. Ask ECPD for its most recent annual report which will describe its principles, organization and procedures. It is difficult to recommend who in each country should do the accrediting, but if an independent agency can not be found, then a government agency should be considered for this function.

5. *Graduate Student Follow-up.* Ideally a technical institute should train the student for jobs now, five years from now and ten years from now. One way to achieve this is to continually survey all graduate students as to their present job duties, what training they received that they use and do not use and what courses they should have had but did not get. In this way curricula can be continually revised to keep them current and new trends can be detected that may lead to adopting new curricula and even to dropping obsolete curricula.

Progressive modernization of curricula should be made one of the requirements for accreditation to assure that all technical institutes persistently carry it out.

6. *Terminology.* The description "short courses" to describe technical institute curricula, everyone agrees, is not an appropriate name to attach to courses that are to become an important part of the total educational system. The technical institutes, along with the trade schools, will probably have a greater effect on the industrial development of the country than any other segment of the educational system.

At this early stage of development, a meeting of those involved in technical institute education and those employing technicians should be convened to establish terminology for the names of the institutes, a generic title to describe the curriculum, or type of courses, and an appropriate title for the graduates.

7. *Students*

A. **Student Sources.** The attitude of the Central American toward getting as much education as possible is gratifying to behold for students are very eager and determined to receive an education. In many cities, it was amazing to see the great number of adults attending the night schools (good and bad) to improve their education.

Prospective students for technical education are:

(1) Graduates of secondary schools.

(2) University drop outs. Since less than 50% that enter, graduate from universities this is a potent source.

(3) Graduates from trade schools who have at least 11 years of education.

(4) Students who have not quite graduated from high school but have extensive related industrial experience.

B. **Entrance Requirements.** Many institutions seek status through high admission standards and inflexible rules while giving little thought to the importance of increasing the educational level of all who can benefit.

Many schools have an open admission policy which leaves the student on his own to prove himself. Therefore, an alternative admission policy is proposed as an experiment with the intent to modify it as experience is gained.

(1) Accept those in the upper 3/5 of their graduating class.

(2) Accept those in the upper 50th percentile on I.Q. and/or aptitude test.

(3) Accept those not meeting the above standards when they show very strong aptitude and motivation.

C. **Retention**. The attitude on the part of some school administrations and faculty that once a student is accepted he is on his own as to accomplishment seems to be very unproductive. If our selection criteria are right, then the student should succeed, and usually he can make it with help and understanding. Most students drop out of school for reasons other than ability. Therefore, a policy to graduate as many of the accepted students as possible should be adopted. This can only be accomplished through understanding and hard work by the administrative staff and individual staff members. A good counseling system must be developed to support the student, administration and staff. A crowning success would be to graduate all students accepted without lowering standards. (Try it, don't waste manpower.)

D. **Foreign Language**. Suggestions have been made that text books for technical institutes be translated into Spanish for the students. It would make it easier for the students and instructors, but we must understand the consequences.

(1) The greatest number of technical books in the world are in the English language.

(2) The task of converting only those books for texts and references is a formidable one that is very costly and would mean translating every new relevant book that came out. (A technical reference library should have a minimum of 5000 texts. This would make translating a costly continuous process.)

(3) Once the student graduates, he must constantly read new material in books and periodicals to maintain his proficiency and these are mostly in English.

(4) Therefore, all students should learn to read English and, preferably, speak it.

(5) A second language is no reflection on a nation's nationalism if that is the trend that the nation is taking.

E. **Salaries**. The present salary scale of technicians may seem low considering the time and money spent for an education, but seems well balanced in the economy. In all probability, as the technician is accepted and his worth recognized, his starting salary will approach that of the engineer, as has happened in the United States and other countries.

F. **Student Recruitment**. As stated time and time again by those interviewed, all Central Americans want and strive for a university education and will not accept less. This is all very well and good, but when you consider how few achieve this goal, it becomes a "pie in the sky" attitude, and is harmful for the nation and their citizens.

(1) A massive educational program is called for to change this attitude. Some of the educational programs used in the United States should be studied to help prepare this program. Judging by the number of students observed in other than university degree programs, many people feel that any additional education is better than none and the people of Central America will strive to get as much education as they can, including technical institute education.

8. *Kinds of Financial Assistance*. This will be discussed under the common section of this report as it applies to all middle-level university education.

9. *Companion studies* should be read in conjunction with this report.[40] These reports are available and it would add nothing to repeat the findings and statistics already available in them.

This general report on Central America gives a view of the technical institute situation as it applies to all countries. Since each country has a different internal situation, an analysis of technical education in each of the Central American countries follows.

COSTA RICA

Population, 1970	1,798,000
% Industrial Occupation	Approximately 19%
GNP Growth Rate in Industry	9%
Secondary School Level Graduates	3.7%
University Graduates	1.7%

Costa Rica is a member of the Organization of Central American States (ODECA) and has a National Institute for Apprentices (INA).

Each year, secondary schools graduate 7,000 students and the universities have places for only 2,500. The many who fail to gain admission to the universities are potential students for technical institutes.

At the present time, Costa Rica does not have an autonomous technical institute but there are some beginnings of technical education.

Some observations: Most universities are not interested in technical institute education because it would divert operating funds from traditional courses. Reflecting their preference for more theoretical programs some university educators consider technical education below their dignity. The University of Costa Rica has made a.start, however, by offering a short course in surveying.

One school that fits into technician training is Colegio Vocacional, Sana Bria. The Director is Monsenor Armando Alfaro P. This is a comprehensive vocational school, but has the potential to develop some university level technical institute curricula because of the dedication of the director.

With its present buildings and equipment, INA also may have some potential for developing technical education. However, this institution is trades oriented and its present staff is not trained in university-level technical education. To start such a program, an engineering staff would have to be recruited, since the present staff is industrial-education and vocational-education trained.

At the present time, no one in government has the responsibility for developing technical institute education. Plans for the establishment of two-year technical institutes are being placed before Congress this year.

Until technical manpower needs are surveyed, it is difficult to know the number and type of technical institutes needed to meet Costa Rican requirements.

For the few and diversified needs discernible at the present time it might be better to send students to another country for technical institute training.

NOTE: *This year the government has sent five students to the Instituto Tecnologico Centroamericano, El Salvador.*

Many of those interviewed feel that government support of private schools might be the best solution at this time.

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[40] See Appendix A.

A survey should be made to determine the need for technical institute training in fisheries and oceanography.

REPUBLIC OF EL SALVADOR

Population, 1970	3,441,000
% in Industrial Occupations	Approximately 19%
GNP Growth Rate in Industry	Approximately 8%
Secondary School Level	2.5%
University Graduates	.2%

Is a member of ODECA–Organization of Central American States.

It has ITCA–The Instituto Technologico Centro Americano (an engineering type technological institute).

El Salvador is unique and fortunate in that they have started a bona fide technical institute: The Instituto Technologico Centro Americano (ITCA).

This school started under the direction of Dr. Denis Martin. At present the school is being sponsored by the British government and the El Salvadorian government. The school is intended to be an inter-Central America technical institute and we sincerely hope in time it will become just that. The school is well equipped and will stress curriculum in mechanical, electrical and civil technology. The opening in 1970 drew applications from 1000 students of which 200 were accepted and at the present time there are students from other Central American countries attending this school under the auspices of their respective countries.

Planning for technical institute education is the responsibility of the Ministry of Education who is also responsible for grades one to twelve.

As in all other countries a technical manpower study is needed to determine the curriculum and the subject matter to be included.

The institute ITCA deserves the wholehearted backing of Dr. Benecke, Ministry of Education, as well as ODECA and industry. One school of this type in El Salvador seems to be sufficient at this time.

Considering the dependence of El Salvador on their fishing industry, it seems appropriate to recommend a study to determine the need for a Fisheries Technical Institute, similar to those in other countries.

GUATEMALA

Population, 1970	5,279,000
% in Industrial Occupations	Approximately 15%
GNP Growth Rate in Industry	Approximately 7.8%
Secondary School Level Graduates	1.7%
University Graduates	.09%

Guatemala is a member of the Organization of Central American States (ODECA).

It has a center of productivity, capacitation, administration and development of business and industry (CENDAP) which conducts short courses of up to three months duration for in-service training.

It has Instituto Centro Americano De Investigacien Tecnologico Industrial (ICAITI) (a regional research and development institute).

Guatemala, the most populated and the most industrialized Central American country, has no technical institute.

By law the National University is responsible for post-secondary education, which to date has created a bottleneck in the development of two-year post-secondary programs. Lack of funds and no one directly responsible for development are part of the problem.

There are four universities in the country:

University of San Carlos–National, autonomous, traditional, 11,000 students;

University of Del Valle–Traditional, three years old, AID funds. Interested in technical institute education;

University Mariano Galvez–Progressive, has industrial emphasis; has 2-year program in instrumentation technology at vocational level.

University Rafael Landivar–Private, liberal, ten years old, 4000 students;

American School–Some thought being given to starting a technical college.

There are no technical institutes in Guatemala, but there are three technical vocational institutes.

There are 60,000 to 72,000 workers in 1500 total industries. Of this number, 520 are large enough to be classified as industrial enterprises and 400 of these are members of the Camara de Industries. At the present time industry indicates its technician needs are for maintenance foremen, accountants and middle management.

A human resources study is necessary to determine the type of technical institute education and the number of technicians needed. Since there appears to be a limited need for engineering technicians at this time, it may be more economical to send students to schools in other countries.

USAID and CENDAP are working on a $2,000,000.00 proposal to assist in establishing a technical institute school at the university level. Depending upon the outcome of the AID loan, the following four schools seem to have the potential to develop limited technical institute programs when industrial needs are established:

University Mariano Galvez–With its present two-year instrumentation technician-vocational program it has a possibility of building a two-year college level instrumentation program with future expansion to an electro-mechanical two-year program.

University Rafael Landivar–This is a private school subject to minimum political pressures which presently has a three-year diploma program in marketing and advertising. Its administration has indicated an interest in two- or three-year engineering technician programs and plans to start programs in science and engineering in one or two years, but needs laboratory equipment.

University Del Valle–This school would like to emphasize technical education and, with encouragement and financial help, may be able to do this; AID funds would help.

Institute Tecnico Vocational–This is an interesting school with a great potential for developing an engineering technical institute. It has almost everything needed except a staff of qualified engineering teachers.

The potential of its graduates is impressive:

40% go to universities;

40% go to industry;

10% leave the country;

10% are unaccounted for.

This record suggests an interesting possibility. With a vocational education background, those graduates going on to the engineering technical institute could be a source for vocational-technical teachers and those going on to engineering in universities could be a good source for engineering technical institute teachers.

For technical institutes to succeed they must have the support of government, industry and the engineering profession. Unfortunately, many professional people expressed the fear that technical institute graduates would be hired in place of engineers and in some cases even replace them in token jobs. This attitude is a roadblock to development and hopefully can be changed.

HONDURAS

Population, 1970	2,583,000
% in Industrial Occupations	Approximately 12%
GNP Growth Rate in Industry	9.2%
Secondary School Level Graduates	2.0%
University Graduates	.15%
Graduate Engineers in Country	360

Honduras is a member of the Organization of Central American States (ODECA).

It has: Universidad Nacional Autonomista De Honduras (UNAH)

Centro Cooperative Tecnico Industrial (CCTI)

Tecnico Aleman in San Pedro (TASP)

Honduras does not have a bona fide two-year technical institute or junior or community college.

Evidently there is no need for a separate technical institute at this time because of low technician requirements in the country. Furthermore, it is doubtful that the economy could support a separate school.

The financial picture may change somewhat if a bill to be presented to Congress were to pass. The bill would levy a tax on industry to aid in training needed personnel at trade and technical levels.

Honduras and the United States are forming an industrial corporation to assist in developing industry. It is planned that some of these funds will be available for scholarships. This should assist in having a limited number of technicians travel outside the country.

The Ministry of Education is apparently responsible for education through the junior college level or two years past the secondary level and is interested in gradually developing this type of education in the country. Its intentions are good, but action has been slow.

As in other countries statistics on technician needs were not available. However, the Department of Economic Planning has made a study which includes a survey of educational needs. The report covers about 600 companies with five or more employees. Hopefully this will give some insight into the technical training programs necessary to produce technicians in the specialties required by industry. This report should be ready in October, 1971.

UNAH is one university that could produce a limited number of technicians at a minimum cost. At present the university has two 18-month programs in topography and bacteriology. As industry expands, some thought is being given to other fields of technology. The university would need additional funds.

A private school that has merit is CCTI, a post-secondary school that operates 7-9 AM and 7-9 PM five days a week for people in industry. Costs are paid by the students and industry. Over a ten-year period it has offered 400 courses for 9000 people. Although its greatest emphasis has been on business and management programs, it has the potential to develop technical institute type education. It has the know-how, interest and political independence.

Although TASP may have some potential, it is basically a trade school.

NICARAGUA

Population, 1970	2,021,000
% in Industrial Occupations	Approximately 18%
GNP Growth Rate in Industry	9%
Secondary School Level	1.3%
University Graduates	.15%

Nicaragua is a member of the Organization of Central American States (ODECA).

It has: National University (UNAN)
University of Central American (UCA)
Instituto Politecnico de Nicaragua (POLI-private)
Association Nicaraguenso de Instituciones de Educacion Superior
Student Loans for Education (INDE)

As in other Central American countries, very little action, but a lot of thought, has gone into development of college-level technical institutes.

Universities and the Ministry of Education have not been responsible for any technical institute or junior college level program, therefore the development has been very limited.

There is a need for intermediate education for persons between the university level and the craftsman. There has been no apparent demand since no technicians are being educated and, therefore, none are available.

There is a great waste in universities because of attrition, very strict standards and inordinate length of time to graduation (as long as ten years).

For technician training, Nicaragua is sending a few students to the British-Salvadorian (ITCA) school now.

There are several schools interested in engineering technician training:

UNAN—The National University has two programs at a hard-to-determine level: a two-year surveying program and a two-year construction program. As contrasted to National Universities in other countries, UNAN indicated an interest in developing technical institute programs under the conditions that additional funds be made available for those programs.

POLI—Instituto Politecnico De Nicaragua—A private school, highly motivated, with good technical institute philosophy.

Total	1968	1969	1970
Enrollments	350	459	454

102 graduates
67 business (Asst. Exec.)
35 Technical Drawing (Dibujo and Publ.)

In the Electro-Mechanical major, 85 started in 1969, with a big dropout due to difficulties in Hydraulics and Electricity; it is now down to 25 students in the second year (about 18 will graduate).

Tuition is $15/month for 10 months. (This is midway between UNAN's tuition of $7/month and UCA's tuition of $25/month.)

Students attend five nights a week from 6–9:30 PM whether working or not.

AID gave POLI $8,000 to lower the cost of books sold to students through the "Regional Technical Aids Center."

Rather than a faculty, the school's urgent needs are for space and equipment. The school needs a classroom building (4-story) for 1,000 students (which is the projected enrollment in five years). Also it needs a workshop-laboratory building for 350 students, costing about $200,000.00. POLI can get the equipment if it has the buildings. (Central Bank has given them $12,000.00 to plan.)

The government decided that "POLI" should handle the "short careers" programs. UNESCO has been interested in providing equipment and faculty assistance. The Central American University is not interested in "short careers" programs. UNAN says there is competition between the schools, but it is not apparent. There is a national law which permits POLI to give a "Technician Diploma" and a title certificate with the President of the country's signature.(41) This is the same type (even uses the same phrases) as the diplomas issued by UNAN and UCA. Some POLI graduates to on in the second year to study at the University. There is a good transfer arrangement through ANIES.

Surveying is taught in two places with lower level admissions:

1. National Vocational High School—three years for a total of 12 years of education.
2. UNAN—a three year program also.

POLI has 54 faculty who are mostly part-time teachers (4–5 full time) paid $7/hour which is the same as the UNAN rate.

POLI's annual budget is $100,000.00, just as the University's. The government aid comes from the Minister of Finance.

[41] See Appendix O.

Like the other Central American countries, Nicaragua needs a technician-manpower study. Also, it is obvious that someone in government must be made responsible for university-level technical institute education.

The best prospect for technical institute education in Nicaragua at the present time is to encourage and help finance a private school, namely, The Polytechnical Institute of Nicaragua under Director Norberto Herrera. This school has the interest, know-how, and enthusiasm.

To assist key industries in Nicaragua, these two-year programs should be explored for development: building construction, irrigation technology and fisheries technology.

Finally, as in other small countries with limited resources, it must be determined, when considering the number of technicians needed, if it is more economical to offer technical institute curricula at home rather than to send students outside the country for training.

CENTRAL AMERICA

Mid-Level Technicians for Health

By Robert L. Love

Summary of General Recommendations

1. *First priority for assistance in the field of health should be given to the following:*

   (a) *Financing for renovating, equipping and expanding present health care facilities.*

   (b) *Financing for a realistic salary structure and an improved status for Health Team members.*

   (c) *Development of more and better qualified lower level health personnel.*

   (d) *Improved health service programs in the areas of nutrition, sanitation, potable water and family planning.*

2. *As the above areas are advanced there should also be the development of Health Technology educational programs of a formal nature.*

3. *Because of the large number of students who graduate from high school and do not enter the university, there should be health technician programs established which could be of the caliber that they would require high school graduation for entrance. This would allow for a higher level of approach to the subject matter included in the technical programs and greater depths of understanding.*

4. *Other technical programs should be developed which would be designed to meet the needs of the particular job to be done and should not be limited in their design to a uniform time requirement for completion or for a uniform educational background.*

5. *There must be adequate time given to the development of all new programs so the cooperating facility personnel (collegiate and health facility) can be brought to the level of understanding of the objectives of these programs.*

6. *Teachers for the health technologies must be prepared prior to the commencement of the new programs and there should be a desire for the continuing education of the teachers.*

7. *A work-study phase of education in the laboratory portion of the technical course work should be incorporated to ensure a well-integrated blend of theory and practical aspects. Care should*

also be given to insure that such educational programs are not perverted to a means for free service for the health facility.

8. *Although the talent is present in the countries involved for the scientific and medical content of the educational programs at the technician level of education, it is recommended that technical assistance be provided for the development of the programs.*

9. *It is recommended that the requirements for faculty positions in this type of technical program in the health field be examined to insure that the appointments are not based on the time-honored requirements of graduate hours and degrees.*

10. *Teacher preparation programs must be developed and the recommendation is that assistance be given by the United States where considerable experience has been gained in the area of health technology teacher preparation.*

11. *Curriculum development should involve the faculty at the earliest possible phase.*

12. *Advisors for curriculum development should be sought from persons involved with successful, existing programs. Since there are now over 400 different community colleges in the United States involved with health technology curriculums this might well be a fertile area for assistance.*

13. *A carefully planned program for student recruitment should be developed with consultant assistance.*

14. *The recommendations to meet the needs for Health Technology education in Central America are given as alternatives to be decided by the local communities. The major overall recommendation is that this type of education be considered a regional rather than a national project. This will assure decisions in the best interests of all the countries.*

    Alternatives:

    (1) *Develop a regional Health Technology Institute.*

    (2) *Develop a regional institute for a variety of technologies including health.*

    (3) *Develop regional programs for certain health specialties with the different programs being initiated in different countries.*

    (4) *Incorporate health technology programs into existing educational institutions such as technical institutes.*

    (5) *Incorporate health technology programs into medical schools or public health schools now in existence.*

    (6) *Incorporate health technology programs into universities as distinct schools or departments.*

    (7) *Incorporate programs into universities as parts of existing schools or departments.*

Recommendations for Immediate Action in Health

1. *Improve the education going on at present in the health technologies. This could be done by developing a series of in-service educational programs such as a series of one-week workshops by such an agency as AID.*

2. *Provide an AID team to work with local health personnel specialists to determine needs, existing facilities and procedure for establishment of an institutional approach to education. Six months study followed by a six month period to develop a working procedure.*

3. *Continued support for the* Assistente de Salud *program in Guatemala with the development of similar programs in other Central American countries.*

4. *Establish a one-year project to further the current programs for the development of* Promotores de Salud *or equivalent personnel including a plan for development, implementation and evaluation.*

5. *Greatly expand the present AID programs in nutrition, family planning, potable water and sanitation. This would include the development of a centralized information promotion office for Central America.*

6. *Establish a one-week meeting for AID personnel in the above areas (#5) to establish priorities and needs to develop a funding proposal and general approach to improved support of this component of preventive medicine.*

7. *It is strongly recommended that the "brain drain" from these countries might well be slowed if there were a close scrutiny given to the health workers salary structure. It is felt that this must have immediate attention to indicate an intent to upgrade the health technician.*

8. *It is recommended that assistance be given to the Rural Reconstruction Movement of Guatemala, with an intent to assist in the incorporation of health into the concerns of the Movement. Furthermore, that this approach be promoted in other countries.*

9. *It is recommended that the government aid in insuring the quality of patient care by developing licensing procedures for the health professionals and accreditation of educational programs in the health field.*

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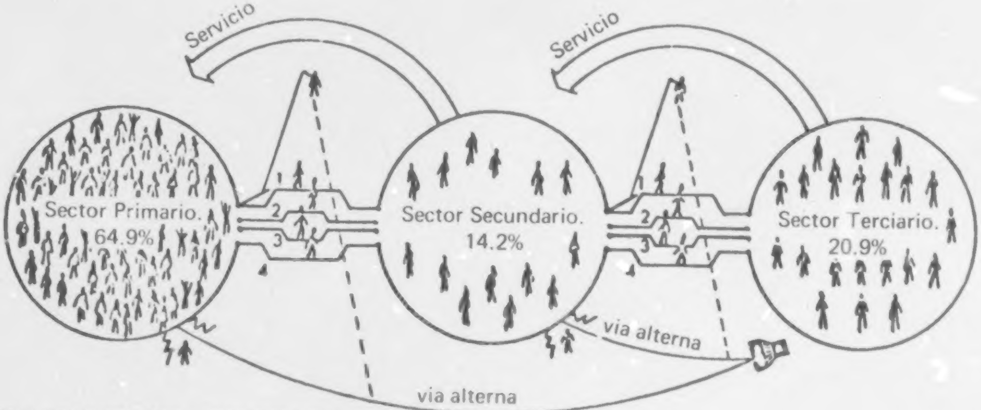
Introduction to Health

Ever since man evolved from lower forms of life, he has been concerned with the development of a personal well-being. His natural tendency to be a communal organism has led to many pleasures and many problems. Among the problems is the desire to raise his standard of living so that the pleasures of life outweigh the displeasures. He has found that it is necessary to work with and be concerned as much about his fellow man as with his own immediate needs. As his society has developed, certain pathways of progress have become established which lead to this improvement in well-being.

Dr. Alberto Viau, Chief of the Medical Department of Technical Services of the Guatemalan Institute of Social Security, has shown a parallel between the development of societies and biochemical processes. As indicated in the diagram, he points out that the three economic sectors can be visualized as the biochemical substrate, the leaders of the sectors as the hormones and the socioeconomic conditions as the enzymes or biological catalysts. His reference is to the conditions found throughout Latin America where one finds a large mass of people in the lower socioeconomic stratum, a few in the middle level and a few more in the upper stratum. In order to advance from one stratum to the next, it is necessary that certain enzymatic or catalytic processes take place. These processes reflect the influences of: 1) Energy or Work; 2) Education; 3) Morals and 4) Health. He continues by indicating that attempts to arrive from the lower stratum to the upper by alternate ways that do not include these enzymes result in illnesses in the social economic system. Note also the major service "feed-back" mechanism implied from the upper to the lower strata.

Paralelo entre el desarrollo de las Sociedades y procesos bioquimicos.



SECTOR ECONOMICO: SUBSTRATO
LIDER: HORMONAS
CONDICIONES SOCIOECONOMICAS: ENZYMAS

1. Energia: Trabajo.
2. Educacion.
3. Moral.
4. Salud.

Si se usa via alterna resulta en enfermedades del sistema economico social.

This analogy graphically illustrates the need for a developing nation to invest in the health and education of its people. Although expenditures for health and education may loom large in the budget of a nation with limited resources, this commitment is an investment in the future of a community with the moral will and physical energy to grow.

Therefore, it becomes increasingly important for all people and their representative governments to look at the development of sound health care and health maintenance practices and policies. Having had the distinct privilege of being able to visit Colombia, South America, and the five Central American countries of Costa Rica, Nicaragua, Honduras, El Salvador and Guatemala, and learn from the health leaders the hopes and desires of the people, I am honored to present the following report.

Priorities

As the study in the field of the Health Technologies was being conducted, there was a major concern expressed on the part of leading health personnel in both the government positions and the health facilities that definite priorities be established. It was felt that the recommendations developed with regard to the establishment of health technology education were of critical importance, but should be examined in their proper order of priority.

The following recommendations represent a combination of ideas expressed by the health leaders at both government and practitioner level and those which became apparent as a result of information gathered and awareness developed during the study.

Education of Technicians for the Health Technologies

Although one objective of this study is to examine technical education in the health field, it becomes readily apparent that it is not practical to take health technology education out of the context of the total health picture in Latin America. Since personal health and improved patient care should be the focal point of our study, let us look at some of the problems that become apparent and think in terms of priorities of the order in which these problems might be solved.

It seems as though there are four areas that must receive attention before technical education in the health field can be really meaningful. These four would all have first priority, and might be considered as follows:

1. Finances for Renovation and Expansion of Present Facilities:

Although there are several new hospitals and health centers available in the different countries, there are more of the facilities that are overcrowded and inadequate with regard to laboratories, record rooms, patient care areas, therapy departments and equipment in general. Existing central, regional and local hospitals, health centers and clinical laboratories must be upgraded, modernized and better equipped. In most instances, the hospitals and health facilities do not currently provide the space or facilities to be able to use increased health technician personnel. It is necessary that increased government funding be available to modernize the physical plants, to provide updated, technical instrumentation and to provide adequate space for health technicians to perform their various functions related to patient care. At present, there are insufficient funds even to properly run the existing facilities. In particular, the laboratories and patient units in the hospitals are operating with little or no advantage of modern equipment. An example is a modern hospital of 470 beds performing 1,000 laboratory determinations per day and 100 parisitology determinations per day with only ten laboratory personnel and 14 students. In addition, there is no automated equipment in any of the laboratories. If the automated equipment were available, there would be a much greater opportunity for the extension of the quality control program as well as for increasing the types of services the physicians would be able to receive. Another hospital visited had 120 beds and one technician in a "laboratory" approximately twelve feet by fourteen feet. This laboratory had a microscope and some glassware. Other types of equipment were non-existent.

There is also a great need for increased health care facilities in rural areas. In many communities, there are no health care facilities of adequate size to meet the needs of the population. Examples of this are a community of 13,000 people with no hospital; another community of 70,000 people with one twelve bed maternity hospital; a health unit with the only equipment available for diagnosis consisting of a stethoscope and a pencil flashlight.

Along with funds for equipment and renovation must be included the personnel for repair and maintenance. It is extremely dangerous to convert a laboratory to use modern equipment if there is not inclusion of a repair and maintenance program concurrently. The reason for this danger is that the hospital becomes geared to the provision of much greater patient service for the physicians and, if the equipment is taken out of service, there is no way to continue this and provide reasonable patient care. There is a need for many new health facilities in hospitals in many areas of the countries. It appears, however, that this expenditure for new facilities should be held in abeyance until the existing facilities are being used to their full potential. At that time, or if there is definite need demonstrated earlier, there will need to be financing for the building, equipping and staffing of new hospitals. This must be an ongoing type of support and under no circumstances should a building program be initiated without a full plan for future support. If this is not done, the financial waste will be enormous, since there will be inadequate funding to maintain the facility after it is built. This will then lead to reduced patient care.

2. Finances for a Realistic Salary Structure and Improved Status for Health Team Members

Before a reasonable marketing approach to increasing the number of persons entering the allied health field in these countries is possible, it will be necessary to improve the salary system and status which these people achieve when entering this field. In most instances, the health team members, other than the physicians, receive wages that are more or less comparable with the lower levels of semi-skilled workers in industry. Monthly salaries for different health team personnel vary according to country, but the salaries, on the average, are at a very low level as seen by the following ranges:

Technical Category	Monthly Salary U.S. $
Medical laboratory personnel	75-200
Nurse	80-200
Auxiliary nurse	35-90
Cleaning	30-35

The problem is that there is no allowance for the education and responsibility associated with health team work. Furthermore, the salaries are far less than comparable education requirements would dictate in industry. The old system of semi-volunteer labor for the hospital is being perpetuated. In addition, there is no system of financial advancement. That is, a person receives the same salary regardless of his effectiveness or length of service.

To upgrade the level of health team workers, adequate education is required. For persons to seek education prior to employment, they should expect financial rewards commensurate with the effort and time involved in pursuing this education. In the health field at present there is no reward and, therefore, few educational incentives. The system of "on-the-job-training" is utilized in all facilities. Personnel is drawn from among those willing to work in a sub-standard environment with little or no equipment and at sub-standard salaries.

Furthermore, there must be an enhanced social status attributed to the health worker and to the educational program which prepares him for his technical position. At present in Colombia, health technology programs are often established as "carreras cortas" (short career) programs. In the words of Dr. Villarreal, Director of ICFES (Instituto Colombiano para el Fomento de la Educacion Superior), these carreras cortas programs are often considered to be . . . "the last disgrace that young people would have happen to themselves if they have University ambitions." Obviously a status within the health field itself for both the health worker and the type of educational program designed for him needs to be established. (A question is raised as to why present programs are called "short career" programs; it is not the career that is short, but the formal education period.)

In order to attract people into the health field, it will also be necessary to develop a plan for periodic salary increases and promotions to positions of increasing responsibility. Quality persons are not likely to enter a career where the opportunities for advancement are non-existent.

3. Development of More and Better Qualified Lower Level Health Personnel

The general consensus of physicians and allied health personnel with whom the problems of health care were discussed was that there is a great need for an increased number of lower level health team personnel. Reference to the Table on page 77 shows the drastic nurse shortage in Central America. In Colombia, the situation is even more severe, with a ratio of five physicians for each nurse. It becomes readily apparent then, that the main health care is going to be given by lower level personnel. Again, the need is for financial assistance to prepare better qualified and more personnel at the level of the auxiliary nurse, sanitary inspector for rural areas, *promotores de salud** and others. These needs are the most urgent, since there is not the proper financial and physical structure for higher level health technicians at this time. Until the physical plants and financial problems can be somewhat alleviated with regard to salaries, there is no place for better educated personnel. They have no place to work and they cannot be paid a salary to attract them. If the limited funds of the Health Ministries are diverted at this time to developing educational programs resulting in a higher type of technician who will then leave the country because of working conditions and salary, the health situation will only deteriorate more.

In the rural areas where there are no health facilities comparable to hospitals, programs are needed to raise the instructional quality of more persons to work with the people in their homes and communities. The better utilization of the sanitary inspectors and malarial control personnel already trained provides a ready source of people for rapidly initiating a program. The type of program being developed in Colombia for the preparation of volunteers and *promotores de salud* needs great expansion and may well be applicable for the Central American countries also. Again, there must be some financial support for these persons, if the program is to be completely successful. A food or other material subsidy might take the place of a salary.

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*Volunteer or semi-volunteer health promoters in rural areas. They are local girls with a modest amount of training.

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Central American States Health Related Statistics*

Item	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua
General mortality per 1000 population	7.4	12.9	16.8	15.2	16.4
Infant mortality per 1000 live births	88.7	147.3	108.6	166.7	199.4
Mortality per 1000 1-4 year olds	6.0	13.6	30.0	11.9	4.2
Malnutrition—percent of children between the ages of 0-4 years					
Total	57.4	74.5	81.4	72.5	56.8
Grade 1 Malnutrition	43.7	48.5	49.0	43.0	41.8
Grade 2 Malnutrition	12.2	22.9	26.5	27.2	13.2
Grade 3 Malnutrition	1.5	3.1	5.9	2.3	1.8
Doctors per 10,000 population	5.7	2.2	2.5**	1.4	4.3
Nurses per 10,000 population	5.2	2.3	1.5**	0.8	2.0
Auxiliares per 10,000 population	16.5	5.5	5.2**	5.6	8.1
Dentists per 10,000 population	1.4	0.6	0.4**	0.5	0.8
San. Engs. per 10,000 population	0.07	0.03	0.02**	0.05	0.07

Memoria 1969, Ministerio de Salubridad Publica, Costa Rica.

***PLAN DE DESARROLLO 1971-75*, Secretaria General del Consejo Nacional de Planificacion Economica, Guatemala.

4. Improved Health Service Programs

Another top priority is expansion of programs in nutrition, sanitation, potable water and family planning. It makes little sense to think in terms of patient care if the patient is being nursed back to health only to be sent back to an environment where his health cannot be maintained. Since parasites, malnutrition and overpopulation are three of the most pressing health problems in the country, attempts to deal with these threats to health should be greatly expanded, particularly by training more personnel to cope with them. The Table on page 45 indicates the seriousness of malnutrition and infant mortality in the Central American countries. Similar statistics are available in Colombia where parasitic infestation is the major health hazard. The current Shigela dysentery epidemic throughout Central America further points to the need for increased emphasis on sanitation and potable water.

The report by William Sweeney, Ford Foundation, "Suggestions for an Education and Public Information Program for Nutrition, Maternal and Child Health, and Population in Costa Rica" points to the cultural problems of family planning. He describes a well defined procedure that could be followed for mass education in population control. Extension of the educational processes and utilization of the mass media of communications is needed to raise the level of popular understanding of this culturally sensitive issue.

HEALTH TECHNOLOGY EDUCATION

Note that none of the four needs identified above include the development of health technology programs. From this study there appears little to be gained by developing educational programs to prepare health technicians for patient care in an environment lacking adequate facilities, supporting personnel, decent salaries and respected status, all coupled with a public poorly informed about the health necessities of life. Only after programs are developed to meet the above needs should technical education programs be established to prepare health technicians.

1. General Health Technician Needs

Although unique and different social, political, cultural and economic conditions characterize each of the Latin American countries, they share certain common needs for health technology education. While facilities for health care may range from excellent to those which defy description, there still may be seen a basic need for properly educated persons to work in them.

In all of these countries those many students who complete high school but, for a variety of reasons, do not enter the university can be attracted to technicians training programs established at the educational level for which high school graduation would be required. If the entering student has completed high school, then a more advanced approach to the subject matter can be included in the technical programs and greater depths of understanding can be achieved. Although the health workers at the levels of some of the needs, such as *auxilares*, malarial control personnel, *promotores de salud*, etc. need not be encumbered with unrealistic educational prerequisites, the technician on the health team should be developed to the highest skill that is practical and meets the needs of the particular job to be done. All technicians are not likely to need the same degree of education or the same time for completing it. While extending a program of education merely to make the time longer is of little value, arbitrarily shortening it to speed up the output of trained personnel invariably compromises the effectiveness of their role in support of the health professions.

Careful examination of the expressed needs of the countries must take place prior to the development of programs of study. Then, there must be adequate time for bringing all cooperating facility personnel to the level of understanding of the objectives of these programs. Furthermore, there must be prior preparation of teachers for the specific technologies and for the general courses which might be common to many of the programs. Continuing education for teachers so their techniques will not become outdated should be arranged. Planning should include opportunities for short "leaves" for the teachers to renew their practical knowledge.

To ensure that the programs of study are a well integrated blend of theory and practice, a work-study phase should be carefully incorporated in the laboratory program. This practical portion of the program may well be carried out in health facilities. Whenever this is done, however, the teachers and administrators must be ever aware that the program is one of education and not one of patient care or health service. Even though the object is preparation of personnel for patient care and health service, the training period must be as free as possible of a service aspect. Teachers from the educational institution should plan to accompany the students into the health care facilities and provide the instruction for them there. This would avoid adding to the load of overtaxed health practitioners and tempting them to use students for health service work not closely related to the students course of training. The needless repetition of procedures just to serve patients seldom adds to the educational value of a program. More important is to take the time necessary to give the technician a thorough understanding of his role and then put him on the working staff of a health facility. Extended "practice" periods in health education can only be justified as a source of inexpensive labor rather than on any sound educational basis.

Despite differences in various countries, the types of health technicians needed seem to be similar. After questioning health personnel at all levels of government and in all types of existing health team positions, the following needs, at the level of technician, seem to be somewhat universal:

1. First priority level: Nurses, medical laboratory technicians, sanitary technicians.
2. Second priority level: X-ray technicians, medical record technicians, medical secretaries.
3. Third priority level: Therapy technicians such as physical, occupational and inhalation therapists.

These priorities are flexible and affirm the need for each category of the technicians indicated above.

Although the talent is present in Colombia for the scientific and medical content of the educational programs at this level of instruction, there is need for technical assistance for the development of such programs. The need is for personnel who have been through the developmental phases before and who could anticipate some of the problems to be encountered. This would also be necessary for the development of adequate and sound relationships with cooperating health facilities such as the hospitals to be utilized for the clinical phase of instruction.

2. Faculty

The development of faculty for teaching at the technical level is a problem that needs immediate attention if there is to be a program of technical education in the health field.

There is a heavy demand for persons who are both competent in health technology and able to teach well. Furthermore, the traditional avenues for entrance into teaching do not apply in the health areas, since there are no graduate programs in most of the health technology areas.

To begin with, there must be a realization in these developing institutions and programs that the long, time-honored requirements of graduate hours and degrees for teaching positions in the universities are not practical or possible in the health technologies. It must be accepted that the goal of the technician after graduation is not to be research oriented, but to be a competent practitioner on the health team. Therefore, the teacher must be a person who has achieved a certain degree of stature in the practice of health technology. He must be able to relate technical work to clinical activities that serve the needs of the community. In other words, the teachers of health technology must be both doers and thinkers. Only such teachers can train students oriented toward a practical, knowledgeable technology.

The source of teachers is now, and will continue to be, the health teams in the hospitals and other health facilities. This does not preclude using others well qualified in science for the basic courses, but preferably these persons should also be health-oriented. Putting health orientation programs into the in-service education for the faculty holds promise for improving the integration of the basic sciences with the technical specialties.

Technical assistance in the preparation of teachers by the United States is strongly recommended. W. K. Kellogg Foundation has done a study of health technology teacher preparation and would undoubtedly be a source of information and assistance. The State University of New York at Buffalo has had a program for health technology teacher preparation for several years and has prepared teachers in such specialties as medical records, environmental health, occupational therapy, biomedical engineering and others. The students have come directly from the practicing health team into the collegiate program. A program such as this might well be applicable to the needs of the Central American countries.

3. Curriculum

The heart of any educational program is the curriculum. The development of a curriculum for the various health technology programs needs to be based on a set of sound educational behavioral objectives. In order to best arrive at a workable curriculum, there should be a preliminary determination of the behavior anticipated or desired and then the assembly of a faculty which could best lead students towards this behavior.

Before the planning is too far advanced, the faculty should be involved so that the resulting curriculum becomes theirs and not one that is handed to them to carry out. Since there are many considerations in the health curriculums, a curriculum advisor should be sought from the United States, where the problems of health careers at the technical level are now being explored. In the United States over 400 different institutions of the Community-Junior College type are now engaged in health career education at the technical level. Although the ideal program has probably not been developed, many problems have been confronted and working solutions developed by these institutions.

To assist with this curriculum development, the Association of Schools of Allied Health Professions' Council on Associate Degree and Certificate Programs, No. 1 Dupont Circle, N.W., Washington, D. C., U.S.A. should be contacted. This organization can readily seek assistance from most of the health technology programs in the United States.

4. Students: Motivation and Sources

One of the first and most important problems in motivating young people to enter the health technologies is the development of a sound and realistic career program for them. A comprehensive approach should be taken to the problem of recruitment and retention of students. They must be offered a marketable career, attractive salaries, and career mobility. They ought to expect working conditions that permit attainment of acceptable health standards. An advertising approach to the recruitment of young people into the field might be effective. Although the occupation is not limited to the young, the term young people is used only because the major supply of new students is from the recent high school graduates.

In looking at the items listed above, the obvious requirements are financial support for the hospitals and health facilities which will allow for the development of adequate and professional working conditions coupled with adequate salaries and favorable upward mobility. Unless these are achieved, the recruitment of persons into health careers will continue to be difficult and the quality of the students attracted will be less than satisfactory in many instances.

If no additional financing can be provided the health facilities, then there is little practicality in exploring the means for attracting and retaining new health technicians. Given this additional financial support, then a concerted effort of advertising and popularizing the benefits of health careers would be in order. The different mass media could be used in a campaign to show the personal benefits and social status realizable through devoting one's life to a career of health service. Assistance for the development of a successful campaign might well be sought from the Texas Hospital Association, Dallas, Texas. There a Texas Health Careers unit has been producing materials for mass media and guides for recruitment through personal contacts.

Health Technology in Central America

Since the health technology needs of the Central American countries are so similar, this study considers possible alternative solutions for all five countries collectively rather than a different plan for each.

Alternatives. In examining the various possibilities for locations of curriculums in the health technologies, suggestions included the following:

1. Develop a Regional Health Technology Institute.
2. Develop a Regional Institute for a variety of technologies including health.
3. Regional programs for certain specialties, i.e., regional nursing in one location, regional therapy programs in another, medical laboratory programs in a third, etc.
4. Incorporation of health technology programs in existing facilities such as Technical Institutes.
5. Incorporation of programs into medical schools or public health schools now in existence.
6. Incorporation of programs into universities as distinct schools or departments.
7. Incorporation of programs into universities as parts of existing schools or departments.

Discussion: The following letters (1) through (7) refer to the Alternatives above.

1. *The most effective and wide reaching alternative is to develop a Regional Health Technology Institute.* The following is a suggested proporal for establishing such an Institute.

a. **Personnel**

(1) Administration and Staff

(a) President or Director

(b) Dean of Instruction—one with broad background in health and education.

(c) Faculty—needed are capable and educated teachers who appreciate the values of higher education. False qualifications such as specified degrees should not be required, particularly at the time of the institution's inception, since this will tend to develop a faculty with less competence than needed for successful development of qualified technicians.

(d) Supportive staff of technicians—to be sought from practicing technicians.

(2) Governing Body—It is recommended that the governing body of the Regional Institute be varied in its composition and have no single governmental affiliation. It is recommended that there be the following representation on this governing body:

(a) Representatives from the Ministries of Health and Education of the cooperating countries.

(b) Non-governmental health professional and health technical representatives.

(c) Lay members such as Red Cross and service organization representatives.

(d) Professional educators.

b. **Physical Plant**

(1) Classrooms, including both large and small lecture facilities.

(2) Self-study, audio-tutorial facilities.

(3) Laboratories for basic science courses and specialized technical subjects. The specialized laboratories can be used profitably to train students in advanced procedures and concepts without tying up health facilities.

(4) Conference and seminar rooms.

(5) General activity areas—auditorium, physical education facilities, health room, lounge, etc.

(6) Utilities—ventilation system, water treatment area (softening and distilling), mechanical area, etc.

c. **Regional Facilities**—as a campus resource and for regional support.

(1) Specialized laboratory—this could serve as a toxicology research center or to provide specialized clinical chemistry determinations (PBI, steroids, enzymes, etc.).

(2) Quality control center–here it would be possible to establish a quality control resource for all of the countries in Central America. Test samples could be developed and sent to the various hospital laboratories for use in maintaining a quality control check on their determinations. It would also be a center for the development of conferences and seminars on quality control which could be held on a regional basis. Also, there could be established teams of experts in quality control to present conferences and seminars in the participating countries.

(3) Supervision and Administration Center–Specialized short-term courses and conferences could be developed dealing with hospital administration, nursing supervision and administration, public health supervision and medical record specialties such as consultant courses.

(4) Continuing Education and In-Service Education Center–Although each hospital should develop its own program for continuing education and in-service education, this center could develop these programs for all health technologies. Also, it could be the center for such specialized programs as those for hospital engineers, maintenance personnel, instrument repair and other similar specialties.

(5) Consultant Services–Since there are few, if any, programs for developing efficient utilization of health team members, the Regional Institute could be the center for consulting services whereby there would be specialists available to go to hospitals and health centers to assist in the development of the different specialties such as nursing, laboratory, medical records, etc. This would also provide for an interchange between the different health care procedures and organizational plans so the best of each could be readily shared by all.

2. *The most economical approach to technical education in Central America would be through the development of a Regional Technical Institute.* Such an institute could provide training in all technologies through separate divisions for health, business, engineering and agriculture. It could realize the most economical utilization of core courses and common facilities. The basic sciences and humanities courses could be taken by all students, regardless of their vocational preference. Furthermore, the faculty could be used to great advantage.

An additional advantage in creating a single, comprehensive regional technical institute would be the enhanced opportunity to control the quality of the various instructional programs. With each operating under the same set of educational objectives, equality programs would be maintained while accommodating the individual variances necessary to teaching the different technologies. A series of core courses could be provided which might well be transferable to university programs should the graduates desire to continue their education at a later date. Upward mobility within the career ladder is an important consideration but must be carefully controlled to insure that transfer requirements do not determine the educational content of the technician training program.

3. *Regional programs for certain specialties*–this approach would permit several different countries to develop programs at preferred locations. This specialization at each location would minimize the need to develop a diversified faculty or facility at several different places.

The disadvantages of this approach would be that specialization might overshadow basic instruction. Such overemphasis of the technical specialty might adversely affect the upward mobility of the graduate, so much so that highly specialized training might not appear advantageous to the student. Also cost becomes a factor in establishing multiple specialized institutes.

This alternative would offer the advantage of utilizing existing programs, such as the nursing program at the Esquela de Enfermera in San José, the type of sanitary inspector program developed in El Salvador, a technician branch of the medical technology program seen in the Facultad de Microbiologia at Universidad de Costa Rica, the proposed medical secretarial program at Instituto Politecnico de Nicaragua in Managua, the curriculum of the Esquela de Cytotecnologia at Roosevelt Hospital in Guatemala City and others.

4. *Incorporation of health technology programs into existing facilities.* The development of a Regional Division of Health Technologies in an established technical institution such as the Instituto Politecnico de Nicaragua may well provide an inexpensive way for all of the programs to be developed. There all of the curricula could include as a "core" element such courses as Medical Terminology, Anatomy and Physiology, Orientation to the Health Team, Introduction to Clinical Laboratory procedures and other courses in the basic sciences such as Biology, Physics and Chemistry. In contrast to the third alternative discussed above, multiple faculties to teach these courses at different locations would not be needed. Furthermore, laboratory facilities could be scheduled so as to avoid unnecessary duplication of physical facilities.

In selecting a suitable location both climate and accessibility need to be considered. Further comfortable housing and quality food service should be provided to make life away from home attractive to the students. This can be a major factor in reducing attrition from the programs. If this is done on a national rather than a regional basis, those countries with no existing facilities would find it difficult to support a comprehensive technical institute. In El Salvador, the new Instituto Tecnologico Centro Americano would provide a natural site for such programs and possibly the proposed Instituto Biologico in Guatemala. However, in Costa Rica and Honduras there is no comparable institution, and, although Costa Rica is contemplating the development of such an institution, even if authorized by the legislature, there are no plans for health technologies to be included.

5. *Incorporation of programs into medical schools now in existence.* This poses a series of problems. First, rarely are the medical schools interested in providing the technical level of education. Second, those that do tend to make the technical course simply a watered down version of the medical student course. The result is less than satisfactory, since the training lacks valid content and practical orientation. The only medical school that has expressed an interest in training technicians is the Facultad de Medicina of the Universidad de Costa Rica. Others in the University, however, expressed a strong disapproval to the development of such programs by the medical school within the framework of the University.

6. *Incorporation of programs into Universities as distinct schools or departments.* Separately administered departments would tend to protect the integrity of the technical curricula. However, the Universities all indicated that since there are limited resources for their institutions the addition of a technical school within the University structure would merely dilute the funds available. The discussion of shared laboratories and facilities was seldom met with enthusiasm. The general reaction was that the facilities are already so overcrowded that the addition of another group of students would not be practical. There is also the matter of divided responsibility for equipment and facilities that leads to problems when these are shared.

7. *Incorporation of programs into Universities as parts of existing schools or departments.* This approach would tend to bring out all of the unfavorable aspects indicated in (6) above, plus the likely loss of identity of the technical training program within the University. This would seem to be the least acceptable of the alternatives unless the particular department were in a position to assign funds, space and faculty to such a plan without burdening already overtaxed faculty and facilities.

RECOMMENDATIONS FOR IMMEDIATE ACTION IN HEALTH

1. With the realization that some instruction in health technologies is going on at present in Colombia, one of the first steps should be to improve it by in-service upgrading of the teaching staffs of the existing programs. More specifically, a series of one-week workshops should be held in each of the major cities of Colombia such as Bogotá, Cali, Medellin, Bucaramanga, Cartajena and Barranquilla. Arrangements should include per diem, transportation, and supplies for the participants. The workshops would consider both basic scientific and technical information and recent advances pertinent to the level of instruction in health technician courses. The workshops should include a strong emphasis on teaching techniques and procedures. These should be repeated for each participant at six month intervals. They should provide for question and answer sessions dealing with technical subjects and demonstrations of modern, simplified teaching methods. Sources of technical instructors and instructional materials might well include scientific supply and reagent companies such as Dade Reagents, Miami, Florida; Ortho Diagnostics, Raritan, New Jersey; Physician's Record Company, Berwin, Illinois; and professional organizations such as the American Society for Medical Technologists, Hermann Professional Building, Houston, Texas; Association of Schools of Allied Health Professions Council on Associate Degree and Certificate Programs, One Dupont Circle, N.W., Washington, D.C.; American Physical Therapy Association, 1740 Broadway, New York, New York; National Association of Sanitarians, Lincoln Building, 1550 Lincoln Street, Denver, Colorado and others. These workshops might well be sponsored by AID or some private organization interested in health in Latin America.

2. Provide an AID sponsored team of four persons specialized in the health technologies to work with four specialists from Colombia for a period of six months. During the first three months of this time, one AID specialist and his counterpart would consider the priority of health technology needs, evaluate the existing teaching facilities and staff, and identify the educational resources for each section of the country. The sections might include: Section A – Bogotá; B – Cali; C – Medellin; D – Cartajena. The eight specialists would then convene for a three month period to pool their findings and from these data, attempt to develop a procedure for the establishment of an institutional approach to education in the health technologies including:

a) Location(s) of teaching facility(ies)

b) Technologies (and their job descriptions)

c) Source and preparation of teachers

d) Costs of physical plant construction, development or renovation

e) Source of curriculum development and procedure

f) Length of programs and technical levels to be included

g) Marketing plan for program development, acceptance by the field and student recruitment.

h) Curriculum outlines.

3. Develop an *Assistente de Salud* program of the type found in Guatemala. Inasmuch as physicians are not likely to alter their migration habits and begin to locate in rural areas, the only hope for improving rural health, both from the medical care and preventive medicine standpoint is through the development of sub-professional medical personnel. The success of *Assistente de Salud* programs, as pointed out in the report "PRELIMINARY REPORT ON TOUR OF OBSERVATION OF PROGRAMS OF PARAMEDICAL TRAINING" by Drs. Alberto Viau and Ronaldo Landa, Guatemala, February, 1970, provides a fine basis for the beginning of such a support program in Colombia.

4. Develop programs for the establishment of *Promotores de Salud*, or their equivalent, to help with minor medical care and long range preventive medicine in rural communities. Dr. Oscar Echeverri C., M.D., Departmento de Medicina Social, Universidad de Valle, Division de Salud, Cali, is recommended as a source of information and procedural planning for the development of such programs. To augment the planning that has been done in Colombia, it might be well to use a suggestion given by Ing. Emil Falck of the A.I.D. Health Office in Tegucigalpa, Honduras. The suggestion was that there might well be a ready source of personnel for such a program in the rural collaborators of the Malarial Control Program. The further recommendation is for a team of three health technology specialists to work for a period of one year as follows:

a) For one month, visit and study the program as established by the University del Valle in Cali to learn of the successful features developed there.

b) Following this, select three geographically different areas with one team member to explore with a member of the local Ministry of Health the rural health program of the Ministry of Health. They should take one month to become familiar with the programs.

c) Following this, the team members and their country counterparts should spend one month together to establish a coordinated and unified program for the training, supervision and job description of the *Promotores de Salud.*

d) Develop pilot programs in these geographical areas of the country as a second funding phase of the project, the funding needs to be determined during a, b and c above.

e) Develop a means of evaluating the programs and refining them for use throughout the other areas of the country, assuming they prove to be beneficial.

5. It is more reasonable to stress the importance of preventive medicine than focus all attention on medical care. Therefore, it is recommended that the AID programs dealing with nutrition, family planning, potable water and sanitation be greatly expanded (e.g. tripled) in both funding and in personal assistance. The need for more extensive support can readily be seen in the meager resources available for dealing with these major problems. Information campaigns raise expectations which the limited number of preventive medicine specialists are unable to cope with. A central office should promote a regional approach to informing the public about preventive measures to improve the health of the community. Campaigns for using mass media methods for preparing and disseminating information are needed. Examples of such needs can be seen in both urban and rural settings. The attempt to combat nutritional ignorance is most frustrating when personnel and finances are lacking.

To develop the funds and personnel needed, the AID personnel responsible for these health matters should be called together for a one-week meeting to establish priorities and needs and to develop a funding proposal and general approach to improved support of this preventive area of medicine.

6. The problem of "brain drain," which is a plague to each country, might well be attacked by a realistic review of the health workers salary structure. It is realized that the financial structure of the

country is not such that all current needs and desires can be met. There should be a renewed realization, however, that the dedication of resources to health improvement is an investment and not a true expenditure. The improvement of the health of a nation is repaid manyfold in the productivity and happiness of healthy and energetic people. To improve health requires quality health team members obtainable only if government sources provide funds for a respectable level of income for these workers. The improved performance and permanency of a quality health team will be one of the main factors in improving the total health picture of the nation.

7. It is recommended that restraint be exercised in allocating funds for the building of new hospitals and health facilities in areas where there are existing facilities. Many new facilities have been built that are providing a variety of health services that range from fair to excellent. Since the problem of insufficient income to meet the existing health needs is common in all countries, there must be critical consideration given to proposals for new facilities. The outlying areas that have no currently available buildings pose a different problem from the areas where there are new hospitals and health centers in addition to existing facilities.

8. It is recommended that financial and technical assistance for health technician training be sought from local industries and professions. For example, drug companies, medical supply concerns, medical associations and related professional associations might well provide both funds and a variety of supporting activities.

9. It is recommended that AID develop a team to work with the Movimiento Guatemalteco de Reconstruccion Rural, Apartado Postal 1697, Guatemala City, to investigate the ways by which such a movement could include health aspects and be duplicated in Colombia. Once a procedure is developed, the team would be available to assist the Colombian government. The person to contact at MGRR is Licenciado Adolfo Molina Orantes.

10. It would seem that there might well be a review of the health care administration by the various countries. At present, there are a variety of administrative controls all related to patient care facilities. In some areas, the health centers and hospitals are duplicating physical and human resource facilities by a lack of coordination. There is a great tendency for duplication of effort and expenditure of funds in less than most efficient ways.

11. Often times, resistance to health technician education and development by health professionals stems from a fear that less completely educated personnel may well take over their functions and thus replace them in the job market. It is, therefore, recommended that the government aid in insuring the quality of patient care by developing licensing procedures for the health professions and accreditation of health career programs. A very real example of this concern is seen with the dentists in Colombia. There is marked resistance to the development of dental technicians and hygienists, since they are legally free to establish their own dental practices by merely purchasing the equipment. This not only poses a real threat to the dentists, but also a real threat to quality patient care.

APPENDIX A

CENTRAL AMERICA

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APPENDIX B

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APPENDIX C

Publications—Technical Education

U.S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Office of Education
Bureau of Adult, Vocational and Technical Education
Division of Vocational and Technical Education
Washington, D.C. 20202

Technical Education Programs
Development Branch

May be purchased from the:
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

OE-80006	**Electrical Technology**—A Suggested 2-Year Post High School Curriculum—75¢
OE-80009A	**Electronic Technology** (Revised)—A Suggested 2-Year Post High School Curriculum—$1.00
OE-80015	**Occupational Criteria and Preparatory Curriculum Patterns in Technical Education Programs**—15¢
OE-80019	**Mechanical Technology—Design and Production**—A Suggested 2-Year Post High School Curriculum—70¢
OE-80024	**Electronic Data Processing—I**—A Suggested 2-Year Post High School Curriculum for Computer Programmers and Business Application Analysts—40¢
OE-80030	**Electronic Data Processing in Engineering Science and Business**—Suggested Techniques for Determining Courses of Study in Vocational and Technical Education Programs—30¢
OE-80031	**Chemical Technology**—A Suggested 2-Year Post High School Curriculum—75¢
OE-80032	**Careers for Technicians**—5¢
OE-80033	**Instrumentation Technology**—A Suggested 2-Year Post High School Curriculum—75¢
OE-80037	**Scientific and Technical Societies Pertinent to the Education of Technicians**—35¢

OE-80041	**Civil Technology**—Highway and Structural Options—A Suggested 2-Year Post High School Curriculum—60¢
OE-80043	**Instrumentation and Automatic Control**—25¢
OE-80049	**Pretechnical Post High School Programs**—A Suggested Guide—45¢
OE-80054	**Forest Technology**—A Suggested 2-Year Post High School Curriculum—$1.25
OE-80056	**Criteria for Technician Education**—A Suggested Guide—45¢
OE-80057	**Water and Wastewater Technology**—A Suggested 2-Year Post High School Curriculum—$1.50 (April 1969)
OE-81012	**Metallurgical Technology**—A Suggested 2-Year Post High School Curriculum—$1.25
OE-81014	**Grain, Feed, Seed, and Farm Supply Technology**—A Suggested 2-Year Post High School Curriculum—$1.50
OE-81015	**Architectural and Building Construction Technology**—A Suggested 2-Year Post High School Curriculum—$1.50
OE-82016	**Food Processing**—A Suggested 2-Year Post High School Curriculum—50¢
OE-82018	**Training Food Service Personnel in the Hospitality Industry**—A Suggested 2-Year Post High School Curriculum
OE-80062	**Architectural and Building Technology**—A Suggested 2-Year Post High School Curriculum—$1.50
OE-87021	**Child Care and Guidance**—A Suggested 2-Year Post High School Curriculum—40¢
OE-80063	**Learning for Earning, New Opportunities for Pay Check Education, The Vocational Education Amendments of 1968**—25¢
OE-81015	**Agricultural Equipment Technology**—A Suggested 2-Year Post High School Curriculum—$1.25
OE-87045	**Diesel Servicing**—A Suggested 2-Year Post High School Curriculum—$1.25
OE-87046	**Waiter—Waitress**—A Suggested 2-Year Post High School Curriculum
OE-81016	**Farm Crop Production Technology**—A Suggested 2-Year Post High School Curriculum—$1.50
OE-87042	**Recreation Program Leadership**—A Suggested 2-Year Post High School Curriculum—$1.00
OE-80008-67	**Vocational and Technical Education, Annual Report, Fiscal Year 1967**—$1.60

Free from the: U.S. Office of Education
Technical Education Unit
State Vocational Services Branch
Division of Vocational and Technical Education
Washington, D.C. 20202

Directory of Public Schools Offering Technical Education Programs, Fiscal Year 1969

The Federal Government's Role In The Training Of Technicians (May 1965)

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The Vocational Education Amendments of 1968—Reprint from American Education—December 1968-January 1969

Dynamics of Technology and Society: No Compromise With Ignorance (February 1969)

Communicating With Advisory, Civic, Employer Groups or Other Persons About Technicians—(March 1969)

How Can We Prepare More Instrumentation Technicians (April 1969)

The Prospect For More And Better Technician Education (June 1969)

Education Of Technicians For Water Conservation And Wastewater Control (October 1969)

Programs For Career Opportunities In Child Development (October 1969)

Enrollments In Secondary And Post Secondary Vocational And Technical Education (November 1969)

Programs In 2-Year Colleges To Up-Grade Employees Of Business And Industry (December 1969)

Sources Of Support And Plans Of Action For Administrators Initiating Or Operating Biomedical Technician Programs (March 1970)

Preparation Of Technicians For Environmental Control (April 1970)

Current Support For Technical Education (May 1970)

Preparing Supportive Personnel For New And Emerging Technologies (May 1970)

APPENDIX D

INTRODUCTION TO CENTRAL AMERICA

STATISTICAL CHARTS AND TABLES

SUMMARY

The majority of the population in Central America lives in the rural areas but the current trend is toward urbanization. Most of the people are mestizo, with the exception of Guatemala where more than half of the population is indigenous, and Costa Rica where European stock forms a majority. The population density is relatively sparse with the exception of El Salvador. There is a large disparity in the living standard of the small group (5%) of the very rich and the large majority (80%), which is very poor, with a growing middle class, (15%).* The economy is highly dependent on one or two crops, with a slowly growing industrial sector. Current illiteracy rates, Costa Rica excepted, run from 50% to 60%, create a serious obstacle to socio-economic development.

INTRODUCTION

The five countries of Central America** are located on the Caribbean perimeter, bounded on the north by Mexico, and by Panama on the south. Together they constitute a regional community which although multinational, has a common ethnic and cultural heritage. During the last two decades, a major effort has been made to form a regional community to promote economic, social, cultural, and educational development. This integration effort is notable not only for the significant economic achievements but also for the psychological effect is produced. It has opened new perspectives and presented new challenges.

The path to integration has not been an easy one and major difficulties are still ahead. Nationalism, disequilibrium in socio-economic development of each country, political instability, and many other factors have slowed the integration process. But despite the problems encountered, and even military conflict between neighbors, the integration process appears to be irreversible. The countries are small for full independent economic development. The benefits of integration have been too numerous to explore in this report. It should be noted that largely because of integration, the economy of the region has experienced the highest growth rate in Latin America.

SOCIO ECONOMIC FACTORS

DEMOGRAPHIC GROWTH

One of the most pressing problems encountered in Central America is the world's highest rate of population growth. Between 1950 and 1963, the region experienced a 3.2% growth, while at the same time the gross national product increased at the rate of 4.9% per year.*** In the current rates of growth continue, the total population will increase from the present estimate of 15 million to 20 million by 1980,* and will more than double in the next 15 years. The greatest concentrations of people are found in the highlands of southwest Guatemala, the north coast and the valley of Honduras, the interior of El Salvador, the Pacific coast of Nicaragua, and central Costa Rica. With the exception of El Salvador the population density has not yet reached problematic proportions.

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*ODECA-OCEPLAN Study, June 1970, p. 25.

**For purposes of this report, Central America includes Costa Rica, Nicaragua, Honduras, El Salvador, and Guatemala.

***Oferta y Demanda Recursos Humanos en Centroamerica, CSUCA, (1966), p. 1.

TABLE 1

CURRENT AND PROJECTED POPULATION GROWTH AND DENSITY
(In Thousands)

Year	1965	1970	1957	1980	1970 Pop. Density Sq. Km.
Costa Rica	1,490	1,798	2,182	2,650	35.2
El Salvador	2,917	3,441	4,092	4,904	163.9
Guatemala	4,497	5,279	5,976	6,913	47.5
Honduras	2,182	2,583	3,070	3,661	23.0
Nicaragua	1,745	2,021	2,373	2,818	15.5

SOURCE: ODECA-OCEPLAN STUDY, June 1970, pp. 8-9.

The most important structural change is taking place in the trend to urbanization. The percent of urban population has increased from 26.9% in 1950 to 36.5% in 1970.** Another characteristic of population structure is the large percent of young people. For 1970, the estimate for the region is that 46.5% of the population is under 15 years. This large group does not, for the most part, participate in the economic production process.

THE ECONOMY

The economy of the region is closely tied to the export of agricultural products. While this sector produces 37% of the regional gross national product, the range is from about 34% for Costa Rica to 47.4% for Honduras. Nearly 75% of the economically active population is engaged in agriculture. Exports are concentrated in a few commodities which are subject to the fluctuation in world markets, with immediate repercussions on the national economy. There is a great disparity in income between the 64% of the rural population, where the average per capita annual income is only $50, and the urban population.

Manufacturing industry is relatively young in Central America. Its current contribution to GCP is only about 17%. Industrial growth is based primarily on internal demand, government incentives, and growth of intra-regional trade.

EDUCATION

It is a generally accepted axiom that education and development are closely related, and that economic planning should include human resource planning. The educational system should provide

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*ODECA, *Estudio Sobre Situacion, Tendencias y Necesidades de La Educacion Centro-Americana*, San Salvador, 1970, p. 8.
***Ibid*, p. 11.

not only the human resources required by current development plans but also develop human beings more capable of learning (and development) in all areas of human activity.

Much has been written about the deficiencies at all levels of the educational system in Central America. Perhaps the best measure of effectiveness of the system is the educational level of the population. There are no current studies which would provide us with information on this point. The available statistics are out of date (1961 and 1964), the current situation is better and is improving. Table 4, indicates that illiteracy rates range from 50% to 84%. The average number of years of education in 1970 for the population of the region is roughly two years. It is evident that this educational level is too low to meet the requirements of the modern technology. The high illiteracy rates create a serious obstacle to the development of the region. Figure 1 presents the educational level of economically active population in graphic form. While the great differences between input and output is apparent at all levels, the inadequacy is particularly noteworthy at the secondary and higher levels.

Table 5, represents a 10 year projection of net education needs by occupation. The estimates were made by the Council of Central American Universities. If historical output rates of universities continue, the study estimates that only 40% of the above university graduate requirements will be met.

It should be noted that the importance of education to further economic progress is widely recognized in government as well as the educational establishment. Enrollment at all levels has experienced phenomenal growth since 1963, as Figure 2 indicates. But in many cases the expansion in enrollments was not accompanied by the necessary qualitative changes to improve the rates of retention. Figure 3 indicates that at current retention rates, for every 1000 that enter the 1st grade of primary, only 200 complete the primary level, 64 complete the secondary level, and only 4 complete the university. The right side of the pyramid (Figure 3) shows the improved rates of retention which are expected by 1980.

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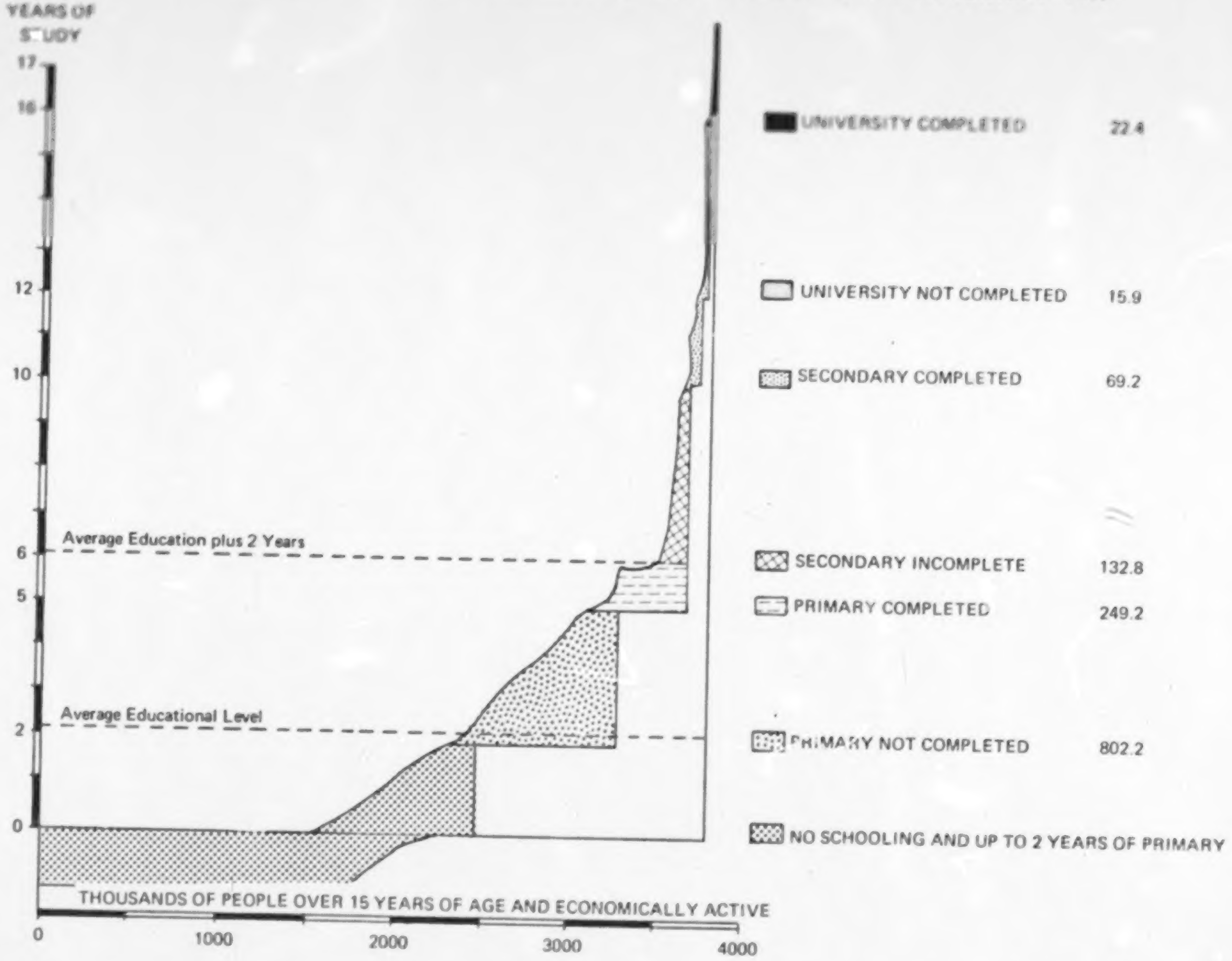
FIGURE NO. 1–EDUCATIONAL PROFILE OF THE ECONOMICALLY ACTIVE POPULATION: 1965



SOURCE: ODECA-OCEPLAN STUDY, JUNE 1970, CH. IV, P. 14

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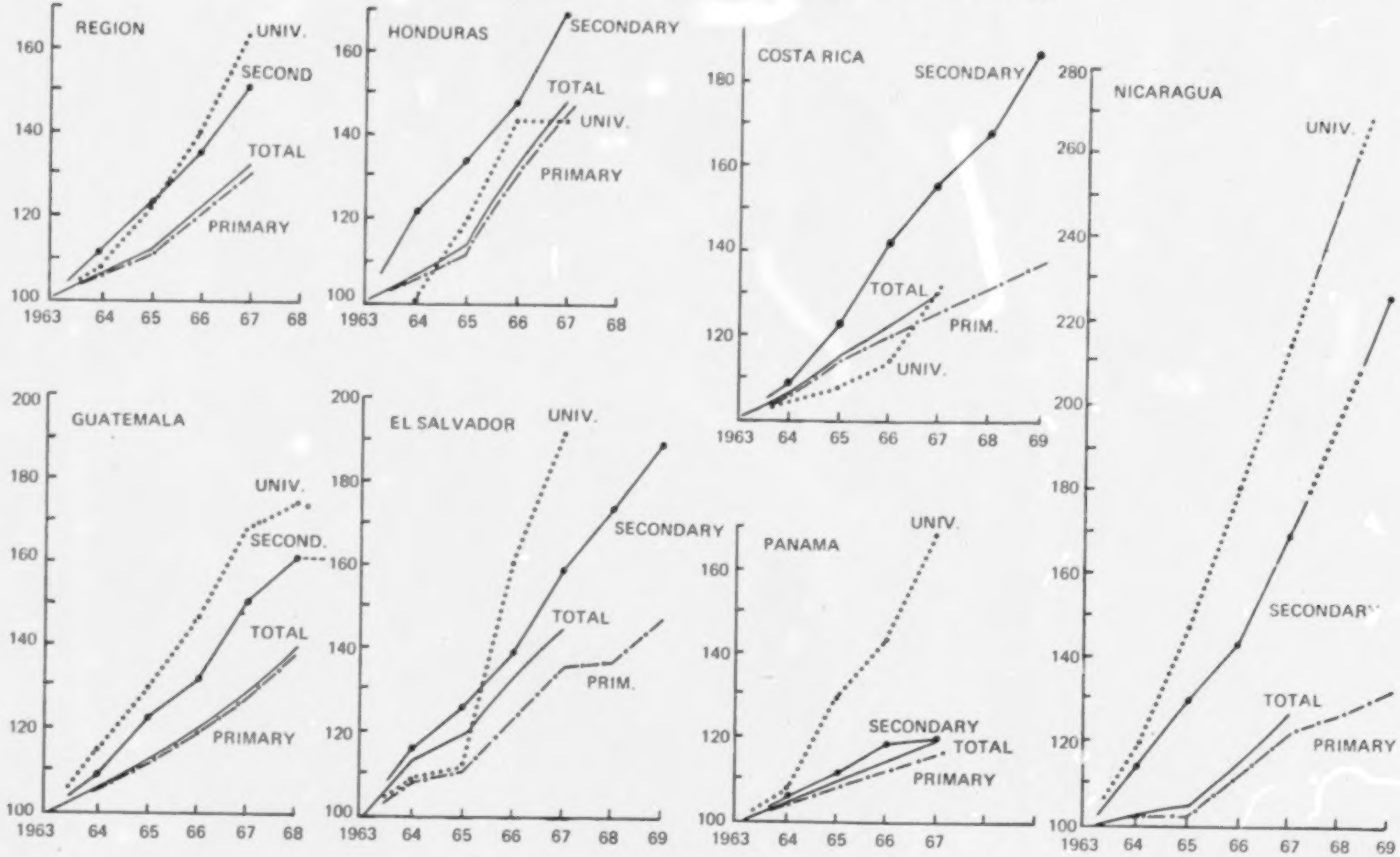
FIGURE NO. 2—REGISTRATION GROWTH BY COUNTRY AND LEVEL



BASE: 1963 = 100

SOURCE: ODECA-OCEPLAN STUDY, JUNE, 1970, CH. 11, P. 14

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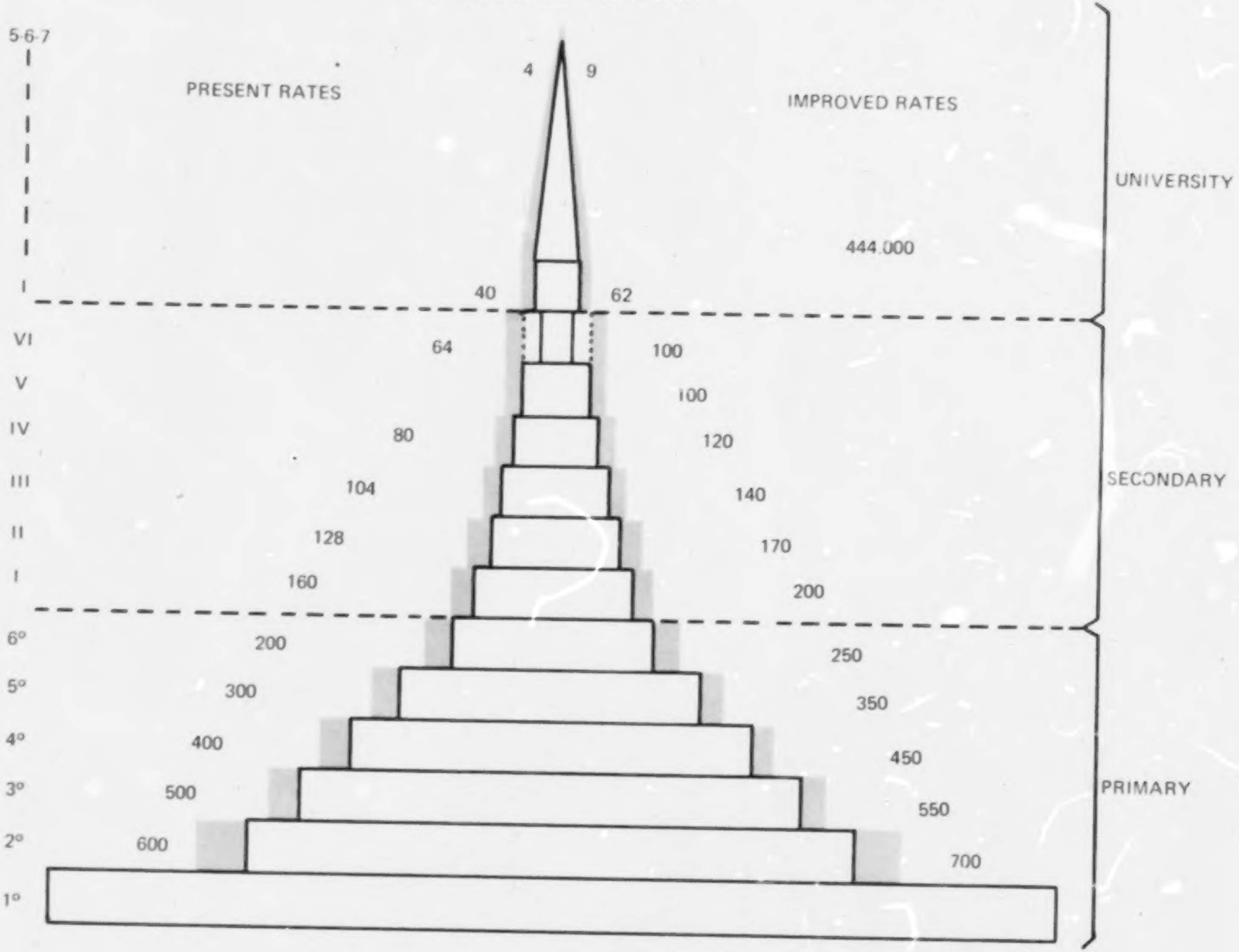
FIGURE NO. 3—RETENTION PROFILE OF A CLASS

For 1000 Who Enter the 1st Grade



SOURCE: ODECA-OCEPLAN STUDY, JUNE 1970, CH. VII, P. 18

TABLE 2

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RELATIVE DISTRIBUTION OF EMPLOYMENT AMONG THE ECONOMIC SECTORS

Country	1950				1963				1964			
	Total	Agriculture	Industry	Services	Total	Agriculture	Industry	Services	Total	Agriculture	Industry	Services
CENTRAL AMERICA	100.0	65.7	13.9	20.4	100.0	60.6	15.2	24.2	100.0	55.6	17.8	26.6
Costa Rica	100.0	56.5	16.6	26.9	100.0	48.9	18.0	33.1	100.0 (2000)*	48.3	20.3 (400)*	31.1
El Salvador	100.0	63.1	14.7	22.2	100.0	60.0	18.3	21.7	100.0 (4000)*	56.6	21.4 (850)*	20.0
Guatemala	100.0	68.2	14.5	17.3	100.0	63.5	14.5	22.0	100.0 (6000)*	57.4	15.5 (950)*	27.1
Honduras	100.0	68.0	9.3	22.7	100.0	63.3	10.1	26.6	100.0 (3000)*	56.1	14.4 (440)*	29.5
Nicaragua	100.0	67.7	15.2	17.1	100.0	59.4	16.4	24.2	100.0 (2500)*	51.1	20.0 (400)*	28.9

*( ) Estimated numbers for 1974 (In Thousands)
SOURCE: CSUCA Study, *op. cit.*, p. 2.

Table 2, above, shows the importance of the various economic sectors for the region and for the individual countries. The dominance of agriculture, and the slow growth of industry is apparent.

TABLE 3

GROSS NATIONAL PRODUCT GROWTH RATES (%)

1950 through 1963 and 1963 through 1974

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Economic Sector	Central America		Costa Rica		Nicaragua		El Salvador		Honduras		Guatemala	
	1950-1963	1963-1974	1950-1963	1965-1974	1950-1963	1963-1976	1950-1961	1964-1974	1950-1961	1964-1974	1950-1963	1963-1971
GNP												
TOTAL	4.7	6.2	6.5	7.1	5.8	6.1	4.5	6.5	3.6	7.1	3.8	5.9
Agriculture	3.5	5.2	2.5	6.6	4.3	5.0	3.7	6.0	2.4	5.5	3.0	5.0
Industry . .	5.2	8.4	7.3	9.7	7.5	9.0	4.4	8.1	5.2	9.2	4.0	7.8
Services . .	5.5	5.9	7.9	6.0	6.7	5.5	5.7	6.1	4.5	7.6	4.3	6.4

SOURCE: CSUCA STUDY, *op. cit.*, p. 6.

Table 3, above, shows the faster relative growth rate of the industrial and services sectors in actual as well as projected figures. The GNP for the region grew at the rate of 4.7% between 1950 and 1963, and is expected to grow at the annual rate of 6.2%.

TABLE 4

EDUCATIONAL LEVEL OF THE POPULATION ACCORDING TO THE LAST CENSUS

(Population over 15 years of age. In Thousands)

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	TOTAL	No Education	Primary		Secondary		University		FUNCTIONAL Illiterates (no education and 1-3 years primary)
			1-3	4-6	7-9	10-12	1 yr. +	Graduates	
GUATEMALA (1964)	2270.9	1606.8	304.3	248.5	59.0	38.2	14.1	(2.0)+	1911.1
Percentage	100	70.8.	13.4	10.9	2.6	1.7	0.6	0.09	84.2
EL SALVADOR (1961)#	1384.6	785.6	(277.0)	(233.5)	(48.6)	(33.8)	3.2	2.9	1062.6
Percentage	100	56.7	20.0	16.9	3.5	2.5	0.2	0.2	76.7
HONDURAS (1961)	984.0	564.8	253.9	118.1	23.0	19.4	4.8	(1.5)+	818.7
Percentage	100	57.4	25.8	12.0	2.3	2.0	0.5	0.15	83.2
NICARAGUA (1963)##	989.7	490.9	292.4	157.8	29.3	13.1	6.2	(1.5)+	783.3
Percentage	100	49.6	29.5	15.9	3.1	1.3	8.6	0.15	79.1
COSTA RICA (1963)	697.1	120.0	240.0	243.4	48.3	25.7	7.6	12.1	360.0
Percentage	100	17.2	34.4	34.9	6.9	3.7	1.2	1.7	51.6

SOURCE: ILPES

# The available data for El Salvador provide only total figures for primary and secondary level. Separate data in this table were estimated.

## Data for Nicaragua represents population of 10 years and up.

+ The number of university graduates in these 3 countries were estimated from other sources.

TABLE 5

Education Needs by Level and Occupation 1963 to 1974
(By Thousands)

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Educational Level and Occupation	Central America	Costa Rica	Nicaragua	Honduras	El Salvador	Guatemala
UNIVERSITY GRADUATES						
TOTAL	37.53	5.66	4.72	5.36	6.29	15.5
0 Professionals	24.05	3.35	3.09	3.40	3.75	10.46
1 Managers	5.78	0.88	0.63	0.50	0.74	3.03
2 Office	1.86	0.61	0.32	0.23	0.32	0.38
3 Sales	1.25	0.26	0.13	0.23	0.22	0.41
4 Agriculture	2.38	0.28	0.26	0.53	0.52	0.79
5-Y Labor	2.21	0.28	0.29	0.47	0.74	0.43
SECONDARY GRADUATES						
TOTAL	144.51	26.79	19.7	20.4	23.19	54.43
0 Professionals	54.23	11.28	7.8	7.6	8.31	19.24
1 Managers	10.21	1.23	1.7	1.6	1.70	3.98
2 Office	39.32	9.11	5.1	5.1	3.89	16.12
3 Sales	7.14	1.35	0.8	1.0	1.04	2.95
4 Agriculture	16.70	0.67	2.1	1.6	5.16	7.17
5-Y Labor	16.91	3.15	2.2	3.5	3.09	4.97
PRIMARY GRADUATES						
TOTAL	500.60	75.59	62.0	96.4	117.28	149.33
0 Professions	29.39	0.54	4.0	5.8	4.79	14.26
1 Managers	13.19	1.96	1.4	1.3	2.83	5.70
2 Office	48.11	7.26	5.7	4.5	5.62	25.03
3 Sales	51.27	10.76	4.5	8.9	10.57	16.54
4 Agriculture	162.43	25.03	16.1	37.1	50.[illegible]1	33.59
5-Y Labor	196.21	30.04	30.3	38.8	42.86	54.21

SOURCE: CSUCA STUDY, 1966, *op. cit.*, p. 10.

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APPENDIX E

SOME CURRENT REGIONAL EDUCATIONAL PROGRAMS FOR CENTRAL AMERICA

Location	Name	Type	Level	Time
Managua, Nicaragua	INCAE (Instituto Centroamericano de Administracion de Empresas)	Business	Graduate Level	1 year
Guatemala City, Guatemala	Central America Institute of Food Marketing at Rafael Landivar University	Agricultural Business	B.S. Degree	4 years
Guatemala City, Guatemala	ODECA (Sponsor) (La Organization de Estados Central Americanos) at Roosevelt Hospital Esquela de Cytotechnologic	Medical	Training Courses	3 months and 9 months
Guatemala City, Guatemala	CSUCA (Sponsor) (Consejo Superior Universitario Centro Americano)	Sanitary Engineering	Master's	12 months
Guatemala City, Guatemala	CSUCA (Consejo Superior Universitario Centro Americano)	Veterinary Medicine	Under-Graduate Program	2 years basic 4 years professional
University of Puerto Rico	CSUCA (Sponsor) (Consejo Superior Universitario Centro Americano)	Agronomy	Master's	18 months
Nueva San Salvador El Salvador	ITCA Instituto Technologico Centro Americano	Mechanical Electrical Civil Technology	Technician (Post High School)	2 years
San Salvador El Salvador	ADS (Sponsor) (Asociacion Demografica Salvadorena)	Demographic Planning Social Service Nursing	Training Courses	1 week
Zamarano, Honduras	Panamerican School of Agriculture	Agriculture	Technician (Post High School)	3 years
Turialba, Costa Rica	Inter American Institute of Agricultural Sciences	Agriculture	Master's	1 year

APPENDIX F

ORGANIZATIONS ADVANCING ECONOMIC INTEGRATION AND DEVELOPMENT IN CENTRAL AMERICA AND PANAMA

ODECA: La Organizacion de Estados Centroamericanos (Organization of Central American States)

CTPS: Consejo de Trabajo y Prevision Social (The Council of Labor and Social Welfare)

CEC: Consejo Economico Centroamericano (The Central American Economic Council)

CETG: Consejo Ejecutivo del Tratado General (The Executive Council of the General Treaty)

SIECA: Secretaria Permanente del Tratado General de Integracion Economica Centroamericana (The Permanent Secretariat of the General Treaty of Central American Economic Integration)

MCP: Mision Conjunta de Programacion para Centroamerica (The Central American Joint Planning Mission)

CCMEP: La Comision Coordinadora de Mercadeo y Estabilizacion de Precios de Centroamerica y Panama (Coordinating Commission for Marketing and Price Stabilization in Central America and Panama)

CCT: Comision Centroamericana de Telecomunicaciones (Central American Telecommunications Commission)

BCIE: (CABEI) El Banco Centroamericano de Integracion Economica (Central American Bank for Economic Integration)

UMCA: Union Monetaria Centroamericana (The Central American Monetary Union)

CCC: Camara de Compensacion Centroamericana (The Central American Clearing House)

OIRSA: El Organismo Internacional Regional de Sanidad Agropecuaria (Regional Plant and Animal Sanitation Organization)

COCESNA: The Corporacion Centroamericana de Servicios de Navegacion Aerea (Central American Air Navigation Service Corporation)

ESAPAC: Escuela Superior de Administracion Publica en America Central (Central American School of Public Administration)

ICAITI: Instituto Centroamericano de Investigacion de Tecnologia Industrial (Central American Institute of Research and Industrial Technology)

CSSP:	Consejo Superior de Salud Publica (The Superior Council of Public Health)
INCAP:	Instituto de Nutricion de Centro America y Panama (Institute of Nutrition of Central America and Panama)
CSUCA:	Consejo Superior Universitario Centroamericano (Superior Council for Central American Universities)
INCAE:	Instituto Centroamericano de Administracion de Empresas (Central American Institute of Business Management)
SITCA:	Secretaria de Integracion Turistica Centroamericana (Secretariat for Central American Tourism Integration)
FCCC:	Federacion de Camaras de Comercio de Centroamerica (The Federation of Central American Chambers of Commerce)
FECAICA:	Federacion de Camaras y Asociaciones Industriales de Centro America (Federation of Central American Associations and Chambers of Industry)

APPENDIX G

CENTRAL AMERICA

STATISTICAL SOURCES
(Graphs and/or Tables)

A. GENERAL

(1) Latin America–Economic Growth Trends–AID, Dec. 1969

(2) World Summary of Statistics on Science and Technology–UNESCO

(3) Statistical Bulletin for Latin America–Vol. V, No. 2, Sept. 1968, United Nations

(4) Statistical Yearbook 1969–United Nations–New York, 1970.

B. CENTRAL AMERICA

(1) La Educacion Superior en Centro America–Estadisticas 1961-1968 (published by) Consejo Superior Universitario Centro America–1969

(2) Esto es F.U.P.A.C.–Federation of Private Universities of Central America Informe Estadistico 1969

(3) Comparative Study of the Educational Systems of the Five Central American Countries–Peter Tobia (A.I.D. Education Officer–Nicaragua)–Ph.D. Thesis at Ohio State University

(4) International Commerce–U.S. Department of Commerce–April 6, 1970

Costa Rica

(5) Ley Organica del Instituto Tecnologico de Costa Rica–Minister of Education, Office of Planning (a law proposing to establish the institute) March, 1970

(6) Estudio Sobre la Estructura de la Poblacion Ocupada de San Jose–Minister of Labor and Social Welfare–June, 1966

Guatemala

(7) Boletin Estadistica de la Educacion–Minister of Education, Office of Planning, April, 1970

(8) Anuario Estadistica de la Educacion (1968)–Minister of Education, Office of Planning, 1970

(9) Projecto de Extension y Mejeramiento del Nivel de la Ensenanzo Media–Minister of Comunicaciones y Obras Publicas–1970

Honduras

(10) Standard Statistical Tables, USAID/Honduras Program Office, May, 1970.

STATISTICAL SOURCES ON LATIN AMERICA

EDUCATION

LEGEND: GR = Graphs
T = Tables
A = General
B = Colombia
C = Central America

STUDENT ENROLLMENT

GR-A1 p. 10-11

T-A1 p. 36-38 students teachers growth on 3 levels in 15 countries

T-B1 p. 822 Numbers of schools, faculty, and students

T-B1 p. 823 Money for education 1967

GR & T B6 p. 10-11 Professors and students (3 levels) 1958-1966 for Colombia

GR-B9 Colombia 1966-70 Higher education enrollment by type

GR-B9 1966-1970 Enrollment in higher education by major

T-C4 p. 1 Common Market 1961-1968 trade growth

T-C4 p. 5 Vital statistics on Central America–1968 and regional trade $ by product

PROFESSIONALS

NO'S OF TECHNICIANS % OR RATIO

T-A2 (No. & Ratio p. 19 & 21) (for 3 countries)

FACULTY

GR-B & Tables 3, 8 & 19 Colombia 1966, % full time ½ time & hourly faculty in universities (by field) last page

GR-B9–Colombia 1966-1970 Full time, ½ time and hourly faculty in higher education

T-B9b–Cuadro 21 ICFES 1959-1963 'Technico' Faculty

ATTRITION

T-B6 p. 178 Colombian students and graduates in higher education by field and Sem.

T-B8 Colombia 1961-1970 3 levels–student enrollment, faculty, graduates, rooms construction

T-B10 Colombia INEM comprehensive high schools–No's, fields, and enrollment by school

T-B11 Colombia 1966-1968 Enrollment in middle level programs by university and by field

GR-B12 Colombia spire of attrition 1948-1963 (ICETEX)

CENTRAL AMERICA

T-C1 p. XVI % enrolled in 3 levels 1961-1968 4 countries

T-C1 p. XVIII 1961-1968 University enrollment by country, university and major

T-C1 p. 3 Ditto above by institution

T-C1 p. 37 Projected university enrollment and graduates 1968-1975 (5 countries)

T-C1 p. 63 Student age, population and No's and % in high school and university (6 countries) 1961-1968

OTHER

GR-A1 p. 5 Total Agricultural products & /capita.

T- p. 10-11 Health and Agricultural land areas.

T- p. 17 total agricultural products and /capita

T-B1 p. 823 Agricultural areas, equipment and principle crops.

APPENDIX II

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SELECTED INFORMATION

FROM

LATIN AMERICA

Economic Growth Trends

Statistics and Reports Division
Office of Program and Policy Coordination
Agency for International Development
December 1969

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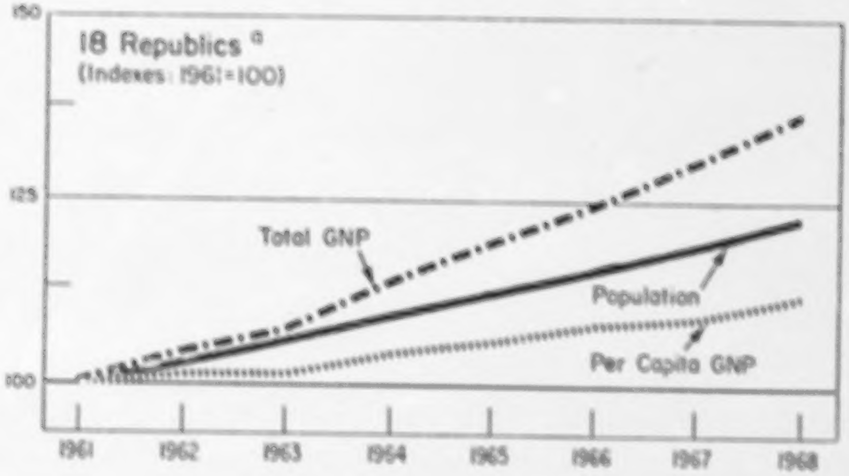
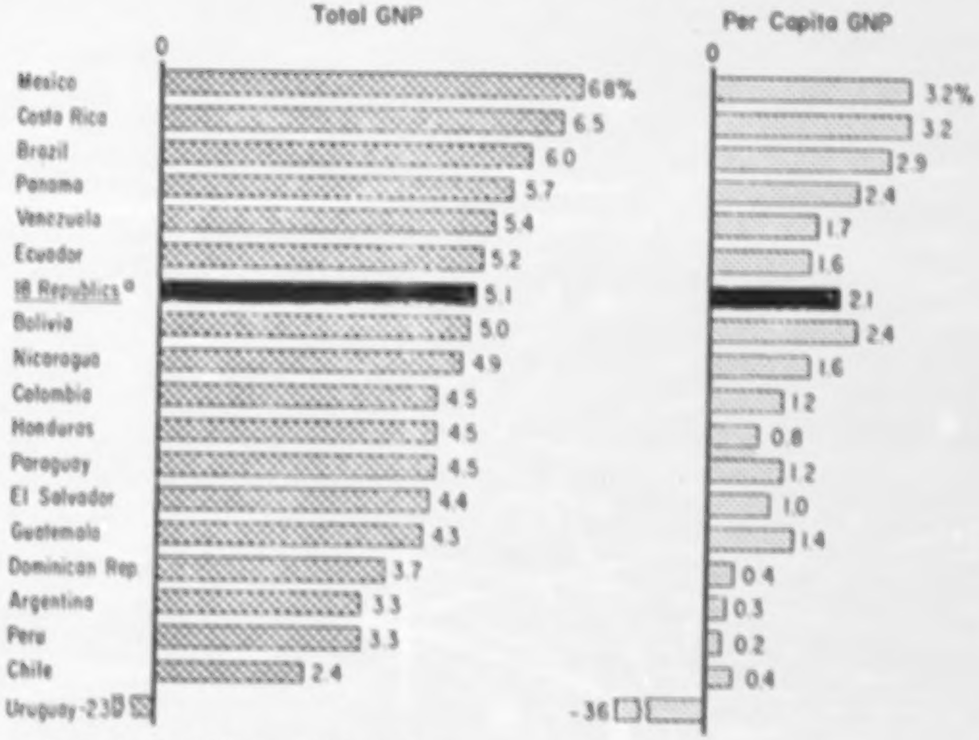
3. GROSS NATIONAL PRODUCT

In 1967 Prices



CURRENT GROWTH RATE b



a- Long term trend data unavailable for Haiti.

b- Arithmetic average of percent change of 1968 over 1967 and 1967 over 1966.

4. AGRICULTURAL PRODUCTION

19 Latin American Republics
(Indexes: 1957-59=100)

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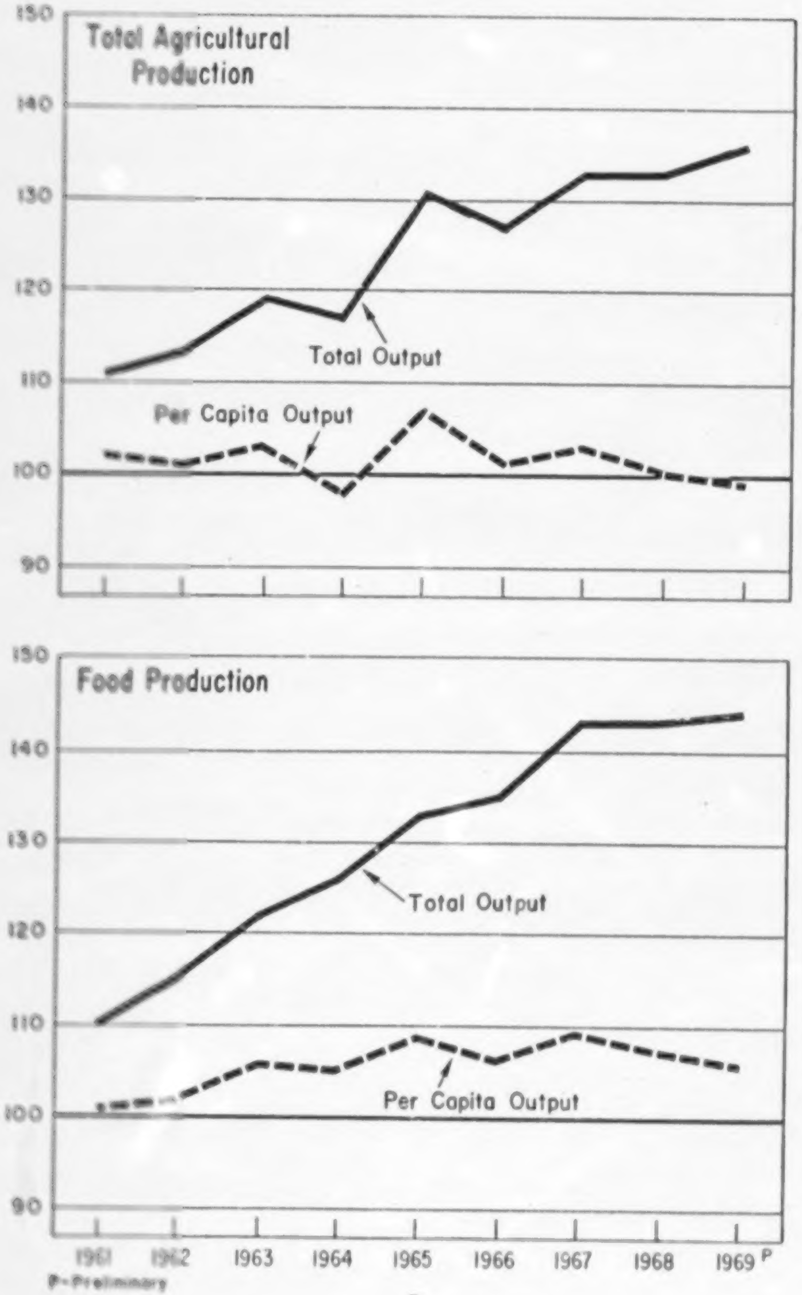

Table I
SUMMARY OF BASIC DATA

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ITEM	DATE	UNIT	COMPARABLE UNITED STATES	19 L.A. REPUBLICS TOTAL	ARGENTINA	BOLIVIA	BRAZIL	CHILE	COLOMBIA	COSTA RICA	DOMINICAN REPUBLIC	ECUADOR	EL SALVADOR
AREA	Latest	1,000 sq. mi.	3,615	7,684	1,072	424	3,286	292	440	19.6	18.8	109	8.3
Agricultural Land	Latest	% of area	47	28	61	13	16	19	17	30	40	18	59
Agricultural Land Per Capita	1969	Acres	5	5	18	8	3.7	3.4	2.4	2.3	1.2	2.1	0.9
POPULATION	1969	Millions	203.2	257.7	24.0	4.5	90.9	9.4	20.5	1.7	4.1	5.9	3.3
Population Growth Rate	Current	Percent	1.1	2.9	1.5	2.4	3.0	1.9	3.2	3.4	3.4	3.4	3.4
Persons Per Square Mile	1969	Number	56	34	22	11	28	32	46	86	218	54	399
Percent Urban	Latest	Percent	70	51	74	35	46	68	52	35	33	36	39
Percent of Labor Force in Agriculture	Latest	Percent	5	46	18	48	52	28	47	49	61	53	60
GNP PER CAPITA (1967 prices)	1967	U.S. $	3,966	422	643	164	347	599	288	421	278	245	285
HEALTH													
Life Expectancy	Latest	Years	71	59	67	50	57	61	60	65	58	54	58
Infant Mortality (per 1,000 live births) ..	Latest	Number	22	79	58	108	92	100	80	70	80	90	63
Hospital Beds (per 100,000 population)	Latest	Number	840	300	630	220	280	410	250	400	290	240	220
Inhabitants Per Physician	Latest	Number	650	1,750	610	3,570	2,530	1,590	2,340	1,860	1,920	3,030	4,110
Per Capita Daily Caloric Intake	1966	Calorie	3,200^{a}	2,550	2,920	1,930	2,690	2,830	2,200	2,610	2,290	2,020	1,840
EDUCATION													
Primary Students as % of 5-14 Age Group* ..	1965	Percent	82^{b}	54	71	46	46	69	43	67	61^{c}	65	49
Secondary Students as % of 15-19 Age Group*	1965	Percent	100^{b}	26	40	23	26	41	23	37	24^{c}	24	19
Students as % of 5-19 Age Group*	1965	Percent	87	47	61	39	41	61	38	60	51^{c}	53	41
Literacy Rate	Latest	Percent	98	69	91	32	61	84	73	84	65	68	49
COMMUNICATIONS													
Telephones	Latest	Thousands	103,750	6,090	1,553	30	1,473	295	735	27	34	45	38
Radio Broadcasting Transmitters	Latest	Number	6,120	3,310	108	75	944	193	239	48^{E}	137	237	67^{P}
TRANSPORTATION													
Roads (Improved, per 1,000 sq. mi.)	Latest	Miles	900	100	56	30	156^{d}	116^{d}	60	194	274	88	314
Motor Vehicles Registered	1968	Thousands	99,960	7,600	1,786	25	2,487	233	241	51	20	54	44
Railroad Passenger-Kilometres	1967	Millions	24,450	-	13,600	n.a.	13,500	2,000	420	26	n.a.	53	n.a.
Railroad Net Ton-Kilometres	1967	Millions	1,050,000	-	11,400		19,900	2,500	1,100	28		66	

See next page for footnotes.

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Table I
SUMMARY OF BASIC DATA (Cont'd)

ITEM	DATE	UNIT	GUATEMALA	HAITI	HONDURAS	MEXICO	NICARAGUA	PANAMA	PARAGUAY	PERU	URUGUAY	VENEZUELA	OTHER	
													JAMAICA	TRINIDAD & TOBAGO
AREA	Latest	1,000 sq. mi.	42.0	10.7	43.3	762	50.2	29.2	157	496	72.2	352	4.2	2.0
Agricultural Land	Latest	% of area	19	31	38	52	14	18	27	23	86	24	42	28
Agricultural Land Per Capita	1969	Acres	1.0	0.4	4.0	5	2.4	2.4	12	6	14	5	0.6	0.3
POPULATION	1969	Millions	5.2	5.1	2.6	48.9	1.9	1.4	2.3	13.2	2.9	10.0	1.9	1.1
Population Growth Rate	Current	Percent	2.9	2.4	3.4	3.5	3.2	3.3	3.1	3.1	1.3	3.5	1.9	2.3
Persons Per Square Mile	1969	Number	123	480	60	64	37	48	15	26	40	28	464	327
Percent Urban	Latest	Percent	34	12	23	53	44	47	36	47	80	72	23	18
Percent of Labor Force in Agriculture	Latest	Percent	65	83	67	47	60	46	54	50	18	32	36	21
GNP PER CAPITA (1967 prices)	1967	US $	291	61	236	528	367	582	221	321	533	911	530	608
HEALTH														
Life Expectancy	Latest	Years	49	47	49	60	54	61	58	53	71	66	65	66
Infant Mortality (per 1,000 live births)	Latest	Number	92	130	86	63	103	54	90	63	43	46	35	42
Hospital Beds (per 100,000 population)	Latest	Number	230	70	160	200	230	330	200	240	470	320	380	537
Inhabitants Per Physician	Latest	Number	3,810	16,000	4,490	1,810	2,350	1,880f	1,870	2,030	880	1,200	1,810	2,610
Per Capita Daily Caloric Intake	1966	Calorie	2,220	1,780e	2,010	2,550	2,350	2,500	2,520f	2,340	3,170	2,490	2,260	2,470e
EDUCATION														
Primary Students as % of 5-14 Age Group*	1965	Percent	34	26	40	59	41	66	61	62g	70	61	66	89h
Secondary Students as % of 15-19 Age Group*	1965	Percent	8	11	11	21	17	46	17	28g	57	34	22	36h
Students as % of 5-19 Age Group*	1965	Percent	25	23	33	49	35	60	49	52g	66	54	35	71h
Literacy Rate	Latest	Percent	38	10	45	78	50	78	74	61	91	76	82	69
COMMUNICATIONS														
Telephones	Latest	Thousands	35	4.3	10	1,046	13	58	16	152	195	327	57	46
Radio Broadcasting Transmitters	Latest	Number	131	26	51P	505	37	86P	19	201	72	169	14	6
TRANSPORTATION														
Roads (Improved, per 1,000 sq. mi.)	Latest	Miles	148	51	33	54d	62	65	22	28	76	66	1,330	2,000d
Motor Vehicles Registered	1968	Thousands	57	16	22	1,524	33	47	19	203	197	524	55	80
Railroad Passenger-Kilometres	1967	Millions	-	n.a.	n.a.	4,300	41	n.a.	14	250	n.a.	39	54	-
Railroad Net Ton-Kilometres	1967	Millions	120			19,700	14		17	650		17	117	7

E - Estimate. P - Preliminary. n.a. - Not available. NOTE: Latest = Most recent yearly data available for the country specified.
* - As reported by UNESCO. Secondary students include general, vocational, and teacher-training. a - 1967. b - Secondary figures include some primary students. c - 1966. d - Includes all roads. e - 1959-61. f - 1960-62. g - 1964. h - 1963; public education only.

Table 2
POPULATION
(millions)

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COUNTRY	1950	1955	1961	1962	1963	1964	1965	1966	1967	1968	1969E	Growth Rate[b]	Percent Urban
TOTAL - 19 Republics[a]	144.80	172.10	204.50	210.50	216.60	223.00	229.50	236.20	243.10	250.30	257.70	2.9%	51%
- CAEC*	8.03	9.36	11.32	11.70	12.09	12.49	12.89	13.30	13.73	14.16	14.61	3.2	35
Argentina	17.07	18.90	21.20	21.54	21.87	22.20	22.54	22.90	23.26	23.62	23.97	1.5	74
Bolivia	3.01	3.32	3.78	3.86	3.95	4.04	4.14	4.24	4.34	4.44	4.55	2.4	35
Brazil	51.94	60.18	71.81	73.95	76.16	78.43	80.77	83.18	85.66	88.21	90.86	3.0	46
Chile	6.07	6.87	7.97	8.15	8.34	8.52	8.70	8.88	9.06	9.23	9.41	1.9	68
Colombia	11.34	13.17	15.89	16.40	16.92	17.46	18.02	18.60	19.19	19.82	20.46	3.2	52
Costa Rica*	0.86	1.03	1.30	1.34	1.39	1.44	1.49	1.54	1.59	1.64	1.70	3.4	35
Dominican Republic .	2.13	2.54	3.14	3.25	3.36	3.47	3.59	3.71	3.84	4.00	4.10	3.4	30
Ecuador	3.23	3.75	4.50	4.66	4.81	4.98	5.15	5.33	5.51	5.70	5.89	3.4	36
El Salvador*	1.86	2.14	2.53	2.61	2.70	2.79	2.88	2.97	3.07	3.17	3.28	3.3	39
Guatemala*	2.80	3.31	4.04	4.18	4.32	4.47	4.60	4.73	4.87	5.01	5.16	2.9	35
Haiti	3.35	3.74	4.25	4.35	4.45	4.56	4.66	4.77	4.90	5.02	5.14	2.4	12
Honduras*	1.44	1.66	2.00	2.07	2.14	2.20	2.28	2.36	2.44	2.54	2.62	3.4	23
Mexico	26.28	30.56	37.27	38.54	39.87	41.25	42.69	44.14	45.67	47.27	48.92	3.5	53
Nicaragua*	1.06	1.22	1.45	1.50	1.54	1.59	1.64	1.69	1.75	1.80	1.86	3.2	44
Panama	0.80	0.92	1.09	1.13	1.17	1.21	1.25	1.29	1.33	1.37	1.42	3.3	47
Paraguay	1.40	1.56	1.80	1.85	1.91	1.97	2.03	2.09	2.16	2.23	2.30	3.1	36
Peru	7.97	8.79	10.32	10.63	10.96	11.30	11.65	12.01	12.38	12.77	13.17	3.1	47
Uruguay	2.19	2.36	2.58	2.61	2.65	2.68	2.72	2.75	2.78	2.82	2.86	1.3	80
Venezuela	4.96	6.08	7.61	7.87	8.14	8.43	8.72	9.03	9.35	9.69	10.02	3.5	72
OTHER LATIN AMERICA													
Barbados	0.21	0.23	0.23	0.23	0.24	0.24	0.24	0.25	0.25	0.25	0.26	1.3	40
British Honduras ...	0.07	0.08	0.09	0.10	0.10	0.10	0.11	0.11	0.12	0.12	0.12	3.0	54
Guyana	0.43	0.49	0.58	0.60	0.61	0.63	0.65	0.66	0.69	0.71	0.73	3.0	16
Jamaica	1.38	1.49	1.65	1.66	1.70	1.74	1.79	1.84	1.88	1.91	1.95	1.9	23
Surinam	0.20	0.24	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.38	0.39	3.5	n.a.
Trinidad and Tobago	0.62	0.72	0.87	0.90	0.92	0.95	0.97	1.00	1.01	1.03	1.05	2.3	18

n.a. - Not available. * - Central American Economic Community countries (CAEC). E - Estimate
a - Country figures may not add to totals due to rounding. b - Estimates of current growth rates.
Source: Mainly UN "Monthly Bulletin of Statistics" and "Demographic Yearbook."

Table 3

GROSS NATIONAL PRODUCT IN 1967 PRICES

(Millions of U.S. Dollars)*

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COUNTRY	1950	1955	1960	1961	1962	1963	1964	1965	1966	1967	1968P	Current Growth Rate[a]	Exchange Rate* per U.S. dollar
TOTAL GNP													
18 Republics[b]	45,456	58,448	74,637	78,654	81,700	83,968	89,361	93,758	97,887	102,299	108,116	5.1%	
CAEC**	1,852	2,321	2,900	2,997	3,185	3,390	3,576	3,822	4,009	4,187	4,402	4.8	
Argentina	9,200	10,625	12,420	13,255	13,030	12,575	13,570	14,835	14,685	14,945	15,650	3.3	350 pesos
Bolivia	n.a.	n.a.	510	521	550	584	610	644	690	712	760	5.0	12 pesos
Brazil	12,560	16,550	22,012	23,675	24,823	25,321	26,110	26,973	28,194	29,743	31,650	6.0	2.0 new cruzeiros
Chile	2,787	3,233	3,970	4,216	4,414	4,631	4,816	5,038	5,343	5,426	5,600	2.4	5.79 escudos
Colombia	2,609	3,403	4,125	4,321	4,535	4,663	4,958	5,113	5,379	5,534	5,872	4.5	14.06 pesos
Costa Rica** ..	258	373	468	482	506	538	539	594	635	671	720	6.5	6.65 colones
Dominican Rep.	490	678	885	836	952	1,001	1,071	927	1,033	1,068	1,111	3.7	1 peso
Ecuador	615	797	996	1,009	1,058	1,108	1,188	1,224	1,283	1,350	1,420	5.2	18 sucres
El Salvador** .	392	489	594	607	669	697	763	803	837	882	912	4.4	2.5 colones
Guatemala** ...	700	783	1,013	1,056	1,094	1,197	1,251	1,306	1,367	1,416	1,487	4.3	1 quetzal
Honduras**	265	333	431	433	453	462	487	520	555	577	606	4.5	2 lempiras
Mexico	8,705	11,750	15,734	16,347	17,058	18,144	19,989	21,091	22,639	24,112	25,820	6.8	12.5 pesos
Nicaragua** ...	237	343	394	419	463	496	536	599	615	641	677	4.9	7 cordobas
Panama	271	325	446	493	537	581	611	664	729	773	815	5.7	1 balboa
Paraguay	274	318	358	377	398	407	417	444	456	477	498	4.5	126 guaranies
Peru	1,588	2,123	2,616	2,830	3,092	3,209	3,429	3,594	3,799	3,974	4,055	3.3	38.7 soles
Uruguay	n.a.	1,476	1,473	1,518	1,484	1,470	1,508	1,518	1,555	1,483	1,483	-2.3	118 pesos
Venezuela	2,811	4,334	6,192	6,259	6,584	6,884	7,508	7,871	8,093	8,515	8,980	5.4	4.5 bolivares

NOTE: GNP data are unadjusted for inequalities in purchasing power among countries. P - Preliminary.
n.a. - Not available. E - Estimate. * - Data converted from national currency into dollars using exchange rates shown. ** - Central American Economic Community countries (CAEC).
a - Arithmetic average of percent change for 1968 over 1967 and 1967 over 1966. b - The 18 Republics listed; excludes Haiti, for which trend data are not available.

Table 6
INDUSTRIAL ORIGIN OF GROSS DOMESTIC PRODUCT
PERCENTAGES OF TOTAL GDP, 1967

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Economic Sector	Argentina	Bolivia	Brazil	Chile	Colombia	Costa Rica	Dominican Rep.	Ecuador	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama^a	Paraguay	Peru^a	Uruguay^a	Venezuela	Total^b
Agriculture, Forestry, and Fishing..............	15.4	19.8	28.3	8.2	30.5	23.0	22.9	33.4	26.4	27.3	38.4	15.9	28.7	21.7	33.0	19.9	15.6	7.4	20.2
Mining (incl. petroleum)...	1.9	13.5	26.7	10.5	2.0	18.8	1.3	1.9	0.1	0.1	1.8	4.7^c	1.5	0.3	0.3	7.2	27.6	26.0	4.9
Manufacturing.............	31.3	16.0		25.9	17.2		16.5	17.0	19.6	14.9	15.0	26.5	14.8	16.3	15.6	15.0		14.6	23.3
Construction..............	4.9	5.2		4.6	4.9	4.5	4.5	4.2^E	3.2	1.9	4.2	3.9	3.2	5.3	3.0	4.8	3.5	4.6	3.5
Electricity, Gas, & Water..	2.8	1.3		1.6	1.5	1.5	1.2	1.5	1.5	1.1	1.3	1.4	1.7	1.9	0.7	1.1	10.1	2.5	1.9
Transport, Communication, and Storage..............	9.4	7.1	8.4	4.7	6.6	4.0	7.0	4.1	4.3	5.5	6.2	4.1	5.1	5.8	4.1	4.4		3.7	6.4
Wholesale & Retail Trade...	12.9	8.8	12.7	22.0	14.0	17.2	17.1	13.0	24.3	28.4	13.9	26.0	19.9	13.5	24.4	15.3	15.1	16.1	17.3
Banking, Insurance, and Real Estate..............	3.9		d	2.8	3.3	2.6	2.1	2.8	1.9	2.4	1.9	d	2.4	3.0		2.9	d	25.1	2.9
Ownership of Dwellings.....		11.3	3.8	2.7	6.0	8.0	6.8	6.6^E	3.8	7.8	8.4	d	7.0	6.7	3.2	5.4	2.5		4.5
Public Administration and Defense..................	11.1	9.5^e	7.0	5.7	6.3^e	10.5^e	12.2	6.6^E	7.5	4.7	2.9	2.6	8.9	2.1	4.3	11.3	d		6.3
Other Services............	6.4	7.5	13.1	11.3	7.7	9.9	8.4	8.9^E	7.4	5.9	6.0	14.9	6.8	23.4^f	11.4	12.7	25.6		8.8

E - Estimate.
a - 1966. b - Total of 18 countries listed. c - Includes petroleum refining and manufacture of coke. d - Included in "Other Services."
e - Includes government services. f - Includes earnings of Panamanians working in the Canal Zone.
Source: Mainly national publications as adjusted by A.I.D./W.

Table 7

INDEXES OF TOTAL AGRICULTURAL PRODUCTION BY COUNTRY

1957-1959 = 100

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COUNTRY	TOTAL PRODUCTION								PER CAPITA PRODUCTION							
	1961	1963	1964	1965	1966	1967	1968	1969P	1961	1963	1964	1965	1966	1967	1968	1969P
TOTAL - 19 REPUBLICS......	111	119	117	131	127	133	133	136	102	103	98	107	101	103	100	99
- CAEC*............	120	136	143	144	145	155	152	152	109	116	118	115	112	116	110	107
Argentina...............	102	116	114	104	111	119	111	118	96	106	103	92	97	102	94	98
Bolivia.................	107	111	111	111	113	109	113	113	100	99	97	95	94	89	92	88
Brazil..................	114	119	109	141	126	135	135	140	104	103	91	115	100	104	101	101
Chile...................	102	108	111	112	113	115	119	112	95	96	97	95	94	94	98	88
Colombia................	106	113	112	118	118	124	128	130	96	97	93	99	92	93	93	92
Costa Rica*.............	119	119	110	116	133	142	148	153	106	99	88	90	99	103	104	104
Dominican Republic......	106	106	105	95	99	103	97	110	95	89	85	75	75	76	69	76
Ecuador.................	122	123	127	134	139	150	141	147	111	105	105	107	107	112	102	102
El Salvador*............	123	138	142	124	129	142	132	146	112	118	118	99	100	106	96	102
Guatemala*..............	118	142	143	162	147	160	158	157	107	120	117	129	114	120	115	111
Haiti...................	110	91	90	91	85	85	80	83	103	81	79	78	71	69	63	64
Honduras*...............	112	117	128	137	139	143	145	135	102	100	106	109	107	107	104	94
Mexico..................	111	124	133	145	145	146	152	148	100	105	109	114	111	108	108	102
Nicaragua*..............	123	158	197	182	190	190	184	169	113	136	165	147	149	145	136	121
Panama..................	103	107	118	133	133	142	147	154	94	92	98	107	104	107	107	109
Paraguay................	106	114	112	115	112	123	118	125	98	100	95	95	89	95	88	91
Peru....................	124	122	130	127	127	123	117	118	114	106	109	103	100	94	87	85
Uruguay.................	110	115	124	120	110	97	111	108	105	107	114	109	99	86	97	93
Venezuela...............	110	134	139	147	153	162	173	178	99	112	113	115	116	118	122	121
OTHER LATIN AMERICA																
Guyana..................	124	114	117	130	124	123	126	133	114	99	99	107	100	95	94	97
Jamaica.................	108	115	119	125	125	115	108	104	103	106	107	109	106	96	88	84
Trinidad and Tobago.....	111	107	105	111	104	105	117	121	101	91	87	90	92	82	90	91

NOTE: Bulk of production in calendar year shown. P - Preliminary. * - Central American Economic Community Countries (CAEC).

Source: U.S. Department of Agriculture, Economic Research Service.

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Table 8
INDEXES OF MANUFACTURING PRODUCTION BY MAJOR COUNTRY

1963 = 100

COUNTRY	1960	1961	1962	1963	1964	1965	1966	1967	1968
11 L.A. Republics[a]	88	94	98	100	110	116	123	128	138[E]
Argentina	104	110	105	100	115	130	129	129	139
Brazil	84	93	100	100	105	100	112	115	134[P]
Chile[b]	80	86	94	100	105	110	118	117	117
Colombia	84	89	95	100	106	111	118	123[E]	n.a.
El Salvador	75	77	85	100	130	159	162	190	179
Guatemala	87	91	88	100	104	113	117	117	114
Mexico	83	86	92	100	114	122	134	146	159
Panama	50	56	81	100	100	114	125	134	n.a.
Peru	77	84	95	100	109	118	130	134	141[E]
Uruguay	103	101	101	100	108	107	109	102	n.a.
Venezuela	79	85	93	100	114	123	125	131	n.a.

n.a. - Not available.   P - Preliminary.   E - Estimate.

a - Index for 11 L.A. Republics is a weighted combination of country indexes; weights are based on value of 1963 manufacturing output derived from GNP data. Weights: Argentina, 23; Brazil, 31; Chile, 6; Colombia, 5; El Salvador, 1; Guatemala, 1; Mexico, 22; Peru, 3; Uruguay, 2; and Venezuela, 6. Weight for Panama is too small to affect the calculations.

b - Excludes copper refining.

Source: Mainly UN "Statisticial Yearbook" and "Monthly Bulletin of Statistics."

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Table 10
ELECTRIC POWER PRODUCTION

A. TOTAL OUTPUT
(Million KWH)

COUNTRY	1961	1963	1965	1967	1968
19 REPUBLICS - TOTAL.........	68,800	79,700	92,800	105,300	114,300^{E}
Argentina..................	11,550	12,450	15,380	16,650^{E}	17,700^{E}
Bolivia....................	460	530	540	600	n.a.
Brazil.....................	24,400	27,870	30,130	34,240	37,800^{E}
Chile......................	4,880	5,620	6,130	6,890	6,900^{E}
Colombia...................	3,780	4,760^{E}	5,820	6,400^{E}	6,900^{E}
Costa Rica.................	460	520	660	760	n.a.
Dominican Republic.........	370	450	500	700	n.a.
Ecuador....................	410	500	570	690^{E}	n.a.
El Salvador................	270	340	420	530	570^{E}
Guatemala..................	290	360	480	540^{E}	n.a.
Haiti......................	65	74	78	78	n.a.
Honduras...................	100	120	180	240^{E}	n.a.
Mexico.....................	11,750	13,640	17,240	20,930	22,800
Nicaragua..................	200	250	310	n.a.	n.a.
Panama.....................	260^{a}	330^{a}	510	580^{E}	620^{E}
Paraguay...................	100	120	130	150^{E}	n.a.
Peru.......................	2,940	3,420	3,840	4,580	4,650^{E}
Uruguay....................	1,330	1,580	1,650	1,950^{E}	n.a.
Venezuela..................	5,220	6,770	8,240	9,480	10,810

B. PER CAPITA OUTPUT
(KWH)

COUNTRY	1961	1963	1965	1967	1968
19 REPUBLICS - TOTAL.........	340	370	400	440^{E}	460^{E}
Argentina..................	550	570	680	720^{E}	750^{E}
Bolivia....................	120	130	130	140	n.a.
Brazil.....................	340	370	370	400	430^{E}
Chile......................	610	670	700	760^{E}	750^{E}
Colombia...................	240	280^{E}	320	330	350^{E}
Costa Rica.................	350	370	440	480	n.a.
Dominican Republic.........	120	130	140	180	n.a.
Ecuador....................	91	100	110	130^{E}	n.a.
El Salvador................	110	130	140	170	180^{E}
Guatemala..................	72	83	100	110^{E}	n.a.
Haiti......................	16	17	17	16	n.a.
Honduras...................	50	56	79	98^{E}	n.a.
Mexico.....................	320	340	400	460	480
Nicaragua..................	140	160	190	n.a.	n.a.
Panama.....................	240^{a}	280^{a}	410	440^{E}	450^{E}
Paraguay...................	56	63	64	69^{E}	n.a.
Peru.......................	280	310	330	370	360^{E}
Uruguay....................	520	600	610	700^{E}	n.a.
Venezuela..................	690	830	940	1,010	1,120

E - Estimate. n.a. - Not available.
a - Public only.

Source: Generally UN "Statistical Yearbook."

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Table 12
TOTAL FOREIGN TRADE
(Millions of U.S. Dollars)

COUNTRY	1961	1964	1965	1966	1967	1968	PRINCIPAL EXPORTS (PERCENTAGE 1965-1967)
19 L.A. REPUBLICS							
Exports	8,120	9,890	10,420	11,080	11,070	11,710^E	Petrol. & prod; 25%
Imports	-7,980	-8,630	-8,870	-9,740	-10,300	-11,340^E	Coffee; 1[illegible]%
Balance	140	1,260	1,550	1,340	770	370^E	
CACM*							
Exports	450	672	759	834	852	949	Coffee; 34%
Imports	-496	-770	-890	-936	-1,028	-1,048	Cotton; 16%
Balance	-46	-98	-131	-102	-176	-99	Bananas; 13%
ARGENTINA							
Exports	964	1,410	1,493	1,593	1,464	1,368	Wheat & corn; 30%
Imports	-1,460	-1,077	-1,199	-1,124	-1,096	-1,169	Meat & prod.; 24%
Balance	-496	333	294	469	368	199	Wool; 8%
BOLIVIA							
Exports	58	93	110	127	145	153	Tin; 62%
Imports	-73	-97	-126	-138	-151	-152	Lead & zinc; 7%
Balance	-15	-4	-16	-11	-6	1	
BRAZIL							
Exports	1,403	1,430	1,595	1,741	1,654	1,881	Coffee; 44%
Imports	-1,460	-1,263	-1,096	-1,496	-1,667	-2,132	Cotton; 6%
Balance	-57	167	499	245	-13	-251	
CHILE							
Exports	506	624	685	877	910	933	Copper bars, ores &
Imports	-598	-607	-604	-755	-868	-920^E	concentrates; 74%
Balance	-92	17	81	122	42	13^E	Iron ore; 9%
COLOMBIA[a]							
Exports	470	581	577	552	548	600^E	Coffee; 62%
Imports	-577	-636	-484	-699	-525	-670^E	Petroleum; 15%
Balance	-107	-55	93	-147	23	-70^E	
COSTA RICA*							
Exports	84	114	112	136	144	172	Coffee; 39%
Imports	-107	-139	-178	-178	-191	-214	Bananas; 24%
Balance	-23	-25	-66	-42	-47	-42	
DOMINICAN REPUBLIC							
Exports	143	179	126	137	156	164	Sugar; 55%
Imports	-80	-221	-100	-185	-201	-226	Coffee; 14%
Balance	63	-42	26	-48	-45	-62	Cocoa; 7%
ECUADOR[b]							
Exports	127	159	180	186	201	210	Bananas; 54%
Imports	-106	-152	-168	-164	-191	-200^E	Coffee; 19%
Balance	21	7	12	22	10	10^E	Cocoa; 11%
EL SALVADOR*							
Exports	119	178	189	189	207	212	Coffee; 49%
Imports	-109	-191	-201	-220	-224	-216	Cotton; 14%
Balance	10	-13	-12	-31	-17	-4	
GUATEMALA*							
Exports	113	167	187	228	199	222	Coffee; 43%
Imports	-134	-202	-229	-207	-247	-247	Cotton; 16%
Balance	-21	-35	-42	21	-48	-25	

See next page for footnotes.

Table 12

TOTAL FOREIGN TRADE (CONT'D)

(Millions of U.S. Dollars)

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COUNTRY	1961	1964	1965	1966	1967	1968	PRINCIPAL EXPORTS (PERCENTAGE 1965-1967)
HAITI							
Exports	32	40	37	35	34	36	Coffee; 46%
Imports	-42	-41	-34	-38	-36	-38	Bauxite; 10%
Balance	-10	-1	3	-3	-2	-2	Sugar; 9%
HONDURAS*							
Exports	73	95	127	143	156	186	Bananas; 47%
Imports	-72	-102	-122	-149	-164	-186	Coffee; 14%
Balance	1	-7	5	-6	-8	0	Wood; 8%
MEXICO							
Exports	822	1,031	1,120	1,199	1,145	1,254	Cotton; 17%
Imports	-1,139	-1,493	-1,560	-1,605	-1,746	-1,960	Coffee; 6%
Balance	-317	-462	-440	-406	-601	-706	
NICARAGUA*							
Exports	61	118	144	138	146	157	Cotton; 42%
Imports	-74	-136	-160	-182	-202	-185	Coffee; 16%
Balance	-13	-18	-16	-44	-56	-28	
PANAMA[c]							
Exports	30	70	79	89	93	95	Bananas; 51%
Imports	-136	-181	-208	-235	-251	-266	Ref. petroleum; 28%[d]
Balance	-106	-111	-129	-146	-158	-171	
PARAGUAY							Meat; 32%
Exports	31	50	57	49	48	48	Lumber; 18%
Imports	-41	-40	-55	-59	-71	-73	Cotton; 6%
Balance	-10	10	2	-10	-23	-25	Quebracho; 6%
PERU							Fish & products; 27%
Exports	494	666	666	763	774	865	Copper; 23%
Imports	-468	-584	-745	-817	-833	-630	Cotton; 10%
Balance	26	82	-79	-54	-59	235	Sugar; 6%
URUGUAY							
Exports	175	179	191	186	159	179	Wool; 47%
Imports	-209	-198	-150	-164	-170	-165	Meat; 27%
Balance	-34	-19	41	22	-11	14	Hides; 9%
VENEZUELA							
Exports	2,416	2,703	2,744	2,713	2,886	2,977[E]	Petrol. & prod.; 92%
Imports	-1,092	-1,269	-1,454	-1,331	-1,464	-1,697	Iron ore; 5%
Balance	1,324	1,434	1,290	1,382	1,422	1,280	
OTHER LATIN AMERICA							
JAMAICA							
Exports	172	216	214	228	224	219	Bauxite &
Imports	-211	-289	-289	-327	-348	-383	alumina; 47%
Balance	-39	-73	-75	-99	-124	-164	Sugar; 21%
TRINIDAD AND TOBAGO							
Exports	346	408	403	429	441	466	Petrol. & prod.; 79%
Imports	-341	-426	-477	-454	-417	-420	
Balance	5	-18	-74	-25	24	46	

NOTE: Exports, f.o.b.; Imports, c.i.f. E - Estimate.

* - Central American Common Market countries. a - Adjusted for unreported trade. b - Data for 1965-66 are export and import permit data adjusted for undervaluation and incomplete coverage.

c - Excludes trade of Colon Free Zone. d - Refined from imported crude petroleum.

SOURCE: Mainly IMF "International Financial Statistics."

Table 21
STUDENT ENROLLMENT AND TEACHER STAFF

(Thousands)

BEST COPY AVAILABLE

COUNTRY	PRIMARY SCHOOLS		ALL SECONDARY SCHOOLS							
			TOTAL		GENERAL		VOCATIONAL		TEACHER - TRAINING	
	STUDENTS	TEACHERS	STUDENTS	TEACHERS	STUDENTS	TEACHERS	STUDENTS	TEACHERS	STUDENTS	TEACHERS
TOTAL - 19 REPUBLICS										
1955..	17,900	550	2,250	210	1,310	110	710	70	230	30
1960..	24,400	720	3,490	310	2,130	170	980	100	380	40
1966..	34,200	1,080	6,650	500	4,470	290	1,510	140	670	70
ARGENTINA.......1955..	2,642	113.7	484	55.7	116	16.6	267	28.0	101	11.1
1960..	2,849	129.7	575	78.1	147	22.8	290	38.1	138	17.2
1966..	3,449	174.1	796[a]	111.2[a]	185[a]	29.3[a]	426[a]	57.8[a]	185[a]	22.1[a]
BOLIVIA.........1956..	294	6.9	38	n.a.	31	2.5	5	n.a.	2	n.a.
1960..	371	13.9	56	3.8	46	2.9	7	0.7	3	0.2
1966..	526[E]	18.9[E]	112[p]	5.3[p]	96[p]	3.9[p]	9[p]	1.2[p]	7[p]	0.2[p]
BRAZIL..........1955..	4,878	165.0	754	69.6	552	40.9	143	19.0	59	9.7
1960..	7,477	226.1	1,178	94.2	868	58.3	219	22.6	91	13.3
1966..	10,695	393.0	2,483	157.7	1,805	99.7	412	32.3	266	25.7
CHILE...........1955..	967	23.4	167	n.a.	116	n.a.	44	n.a.	7	0.5
1960..	1,174[p]	n.a.	229	n.a.	162	n.a.	60	n.a.	7	n.a.
1966..	1,681[p]	41.4[p]	245[p]	19.0[p]	169[p]	12.0[p]	67[p]	6.4[p]	9[p]	0.6[p]
COLOMBIA........1955..	1,236	32.2	131	12.4	77	7.0	42	3.9	12	1.5
1960..	1,690	44.9	243	22.4	140	12.8	75	6.8	28	2.8
1966..	2,408	67.8	513	34.5	320	21.3	130	8.6	63	4.6
COSTA RICA......1956..	154[c]	5.8[c]	n.a.	n.a.	17	1.1	3	n.a.	n.a.	n.a.
1960..	203	7.8	35[p]	1.7[p]	27	1.3	5	0.3	3[p]	0.1[p]
1966..	296	11.1[p]	60[p]	3.6[p]	48[p]	3.1[p]	8[p]	0.4[p]	4[p]	0.1[p]

Table 21
STUDENT ENROLLMENT AND TEACHER STAFF (Cont'd)

(Thousands)

BEST COPY AVAILABLE

COUNTRY	PRIMARY SCHOOL		ALL SECONDARY SCHOOLS							
			TOTAL		GENERAL		VOCATIONAL		TEACHER - TRAINING	
	STUDENTS	TEACHERS	STUDENTS	TEACHERS	STUDENTS	TEACHERS	STUDENTS	TEACHERS	STUDENTS	TEACHERS
DOMINICAN REP...1956..	399	n.a.	19	n.a.	10	n.a.	9	n.a.	0.3	n.a.
1960..	505	8.8	50	n.a.	28	1.2	22	n.a.	0.3	*
1966..	585	10.9	89	3.5	64	2.7	25	0.7	0.4	0.1
ECUADOR.........1955..	461	10.3	44	4.1	27	2.7	12	1.0	5	0.4
1960..	596	15.3	66	6.0	40	4.1	19	1.4	7	0.5
1966..	851	22.4	134	10.3	73	6.6	46	2.9	15	0.8
EL SALVADOR.....1955..	207	6.3	21	n.a.	13	n.a.	6	n.a.	2	n.a.
1960..	321	8.7	34	n.a.	21	n.a.	10	n.a.	3	0.1
1966..	432^{P}	11.9^{P}	60^{P}	2.9^{P}	41^{P}	2.3^{P}	14^{P}	0.2^{P}	4^{P}	0.4^{P}
GUATEMALA.......1955..	214	8.1	20	2.3	10^{d}	1.5^{d}	8	0.8	2	*
1960..	297	9.7	27	4.0	22	2.7	3	0.6	2	0.7
1966..	408^{E}	12.3^{E}	58^{E}	7.4^{E}	44^{E}	5.2^{E}	7^{E}	1.0^{E}	7^{E}	1.2^{E}
HAITI...........1955..	214^{a}	4.4	15	n.a.	12	0.9	3	n.a.	0.2	0.1
1960..	239	5.6	19	n.a.	15	1.2	4	n.a.	0.2	*
1965..	284	6.2	24	1.6	20	1.3	4	0.3	0.2	*
HONDURAS........1955..	128	4.2	10	1.3^{f}	2^{f}	0.3^{E}	5	0.7^{E}	3	0.3^{E}
1960..	205	6.5	16	1.6	10	1.0^{E}	4	0.4^{E}	2	0.2^{E}
1966..	331^{P}	10.9^{P}	27^{P}	2.3^{P}	21^{E}	1.8^{E}	2	0.2^{E}	4	0.3^{E}
MEXICO..........1955..	3,527	85.8	233	21.9	113	11.1	96	7.2	24	3.6
1960..	4,885	111.1	402	36.1	220	22.2	132	9.8	50	4.1
1966..	7,396	157.4	1,004	77.4	804	58.5	143	10.4^{E}	57	8.5

Table 21

STUDENT ENROLLMENT AND TEACHER STAFF (Cont'd)

(Thousands)

BEST COPY AVAILABLE

COUNTRY	PRIMARY SCHOOLS		ALL SECONDARY SCHOOLS							
			TOTAL		GENERAL		VOCATIONAL		TEACHER - TRAINING	
	STUDENTS	TEACHERS	STUDENTS	TEACHERS	STUDENTS	TEACHERS	STUDENTS	TEACHERS	STUDENTS	TEACHERS
NICARAGUA.......1955..	131^{a}	4.7^{a}	7	0.8	4	0.4	2	0.3	1	0.1
1960..	145	4.1^{E}	12	0.9	7	0.5	3	0.3	2	0.1
1966..	224^{P}	6.1^{a}	30^{E}	1.9^{E}	21^{E}	1.3^{E}	4^{E}	0.3^{E}	5^{E}	0.3^{E}
PANAMA..........1955..	138	4.3	26	1.2	16	0.8	8	0.3	2	0.1
1960..	162	5.7	39	1.8	27	1.3	11	0.4	1	0.1
1966..	211	7.1	60	3.0	38	2.1	21	0.6	*1	0.1
PARAGUAY........1955..	266	9.1	16	2.1	5	0.7	8	0.8	3	0.4
1960..	302	10.7	25	3.2	13	1.7	5	0.6	7	0.9
1966..	364^{P}	12.1^{E}	38^{P}	4.9^{E}	33^{E}	4.3^{E}	2^{E}	0.2^{E}	3^{E}	0.4^{E}
PERU............1955..	1,075	28.2	n.a.	n.a.	92	6.4	20	2.7	n.a.	n.a.
1960..	1,440	41.9	202	17.1	159	11.3	39	5.3	4	0.5
1966..	2,157^{P}	60.4^{P}	436	28.3	363^{P}	21.2^{P}	58^{E}	5.6^{E}	15^{a}	1.5^{a}
URUGUAY.........1955..	275	8.6^{a}	67	n.a.	49	n.a.	15	n.a.	3	0.7
1963..	321	9.7^{a}	96	n.a.	70	n.a.	23^{g}	n.a.	3^{E}	n.a.
1966..	367^{P}	11.2^{P}	137^{P}	8.2^{E}	107^{P}	6.0^{E}	30^{P}	1.8^{E}	7^{P}	0.1^{E}
VENEZUELA.......1955..	647	19.5	64	4.4	44	3.4	14	0.4	6	0.6
1963..	1,223	34.7	161	9.6	105	5.2	44	2.4	32	2.0
1966..	1,541	43.4	341^{E}	17.7^{E}	221^{P}	11.3^{P}	109^{P}	4.7^{P}	15^{E}	1.7^{E}

E - Estimate. P - Preliminary. n.a. - Not available.
* - Less than 500.
a - 1965. b - Includes special education. c - 1953. d - 1954. e - Includes pre-primary. f - 1956. g - 1962.

Source: UNESCO "Statistical Yearbook."

APPENDIX I

Project Narrative

Under technical assistance programs of the Agency for International Development (AID) of the U.S. Department of State, many developing countries of the world have created systems of higher education which are actually or potentially meeting the needs of these countries for engineers, doctors, lawyers, business managers, agricultural scientists and others trained to the high professional levels characteristic of the fully developed nations. As happens so often, this achievement has created other needs.

Reflecting initiatives taken in the office of its Director of Engineering, AID determined through queries to the leaders of its missions in a number of less developed countries in the world that a need seems to exist for technicians trained to function in support of the graduates of bachelor and graduate degree programs in engineering, agriculture, the health professions and business management.

AID entered into a contract with the American Society for Engineering Education (See Appendix O for a brief description of ASEE) to organize a field team to go to Colombia and Central America during the summer of 1970 to study the need in these countries for mid-level technical training and to recommend measures to meet this need. In accordance with its standard operating policy, the International Engineering Education Committee of ASEE nominated, and the President of ASEE appointed, a four-man advisory committee to assist the field team and to see to the proper discharge of ASEE's responsibilities under the proposed contract. The members of the field team are:

Chief of Field Party:
Harold P. Skamser
Dean
California State Polytechnic College

S. A. Billon
Professor of Business Administration
University of Delaware

Robert Love
Director, Health Related Technology
Alfred Agricultural and Technical Institute

Robert E. McCord
Associate Dean of Engineering
Pennsylvania State University

R. H. Walker
Department of Agricultural Engineering
Brigham Young University

The members of the advisory committee are:

Chairman, Advisory Committee:
H. E. McCallick
Dean
College of Technology
University of Houston

Bruce Anderson
Professor of Irrigation Engineering
Utah State University

Merton R. Barry
Director, Engineering Foreign Programs
The University of Wisconsin

Harold E. Hoelscher
Dean, School of Engineering
University of Pittsburgh

The biographical information for the field team is contained in Appendix N.

The advisory committee met with Dean Harold P. Skamser, Chief of the Field Party, on May 13, 1970, at ASEE headquarters in Washington, D.C. At this meeting, the other members of the field party were selected, a preliminary plan of operation was adopted, and some information already available on the subject of the study was identified. Working relations among the committee, the field party, ASEE and AID headquarters and the AID missions of the countries to be visited were discussed.

The Field team met with the advisory committee on June 12, 1970, in Denver, Colorado, to review in detail the plans for the conduct of the study. L. M. Hale, Deputy Director of Engineering, represented AID at these meetings and F. X. Bradley, Jr., Director, Projects and Federal Relations, represented ASEE headquarters. Dean Hugh E. McCallick, chairman of the advisory committee, presided.

A contract calling for 297 man days of consultant services by the five-man field team and the four-man advisory board was signed for ASEE by Leslie B. Williams, Executive Director, and for AID by Sophie J. Galuska, Contracting Officer. The effective date was June 11, 1970, and completion date October 31, 1970. Precontract costs from May 1, 1970, of up to $5000 and a provisional overhead rate of 28.6% of total direct costs, exclusive of consultant fees, were authorized. The contract was subsequently modified twice to extend the period of performance, first to December 31, 1970, and then to February 28, 1971.

After spending four days in Washington, D.C. awaiting country clearance from the AID missions in Colombia, all of the team except Skamser left Washington for Colombia on July 10, 1970. The commitment to the team was to have it back in the U.S. by September 1, 1970. Thus, there were available only 53 days within which to accomplish the team's mission involving visits to Colombia and all the Central American countries except Panama. The in-country itinerary of the team is shown in Appendix D.

While the other members of his team were in Washington, Harold Skamser preceded them to Guatemala and Colombia by a week to work out the details of the visits in advance of the team's arrival.

Because of the delay at the outset with the Colombian country clearance, the visit in that country was cut short to keep on schedule for the Central American visits. Consequently, Dean Skamser decided to have the team return to Colombia for a week after finishing the work in Central America. Because of demands on them in the U.S., however, Love, Billon and Walker returned at the end of August as originally scheduled. Skamser and McCord remained in Colombia for the additional week.

A meeting of the team and the advisory committee was called for December 6, 7 and 8 in Washington, D.C. The purpose was to review the work of the team and to determine the form and content of the final report. All members of the team and Merton Barry of the advisory committee attended.

On Sunday, December 6, the field team met at ASEE headquarters to coordinate the contributions of each member of the team to the final report. On Monday, December 7, Barry joined the team and provided much valuable and constructive advice. On Tuesday, December 8, at a meeting arranged by Hale at AID headquarters, the team, Barry and Bradley discusse. [illegible] oject with interested AID officials.

The most striking observation concurred in by all team members was the apparent effectiveness of the team approach to the study. Because of the broad scope of the team's mission, it received widespread attention and assistance from the industrial and educational leaders and government officials in the countries they visited. The team members came away convinced that uncoordinated studies by individuals for each of the four disciplines represented on the team would have been much less productive. They recommended the team approach if this or comparable problems are to be studied in other countries.

APPENDIX J

Partial List of Organizations Visited and Persons Consulted in Central America*

COSTA RICA

Ministry of Education

Dr. Ovidio Soto
Director, Officina de Planeamiento de la Educación

Guillermo Malvassi V.
Director Ejecutivo

Ministry of Labor

Enrique Jimenez Miranda
Director General

Consejo Superior Universitario Centroamericano (CSUCA)

Lic. Sergio Ramirez M.

National Planning Committee

Dr. Roger Valle

Colegio Vocacional Mons. Sanabrice Desamparados

Pbro. Armando Alfaro P.
Director

Camara de Industrias de Costa Rica

Francisco Teran Vales
Secretario

Evases Comerciales S. A.

Rafael Angel Jimenez F.
Director

Compania Nacional de Fuerza y Luz, S. A.

Lic. Jose Antonio Flores Lara
Gerente General

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*The pace of the visits made it difficult for the team to keep a complete and accurate record. Team members apologize to their many Central American hosts and friends who may be left out of this list or improperly noted in it.

Cooperativo de Servicios Aero-Industriales R. L.

Ing. Javier Castro
Jefe Ingeneria E. Inspeccion

Corporacion Internacional de Boston S. A.

Jack S. Harris
Presidente

Super Servicio (Corporacion)

James S. Dahlstrom B.
Presidente

Kastta, S. A.

Nachum Aviram S.
Presidente

Private Consultant

Alberto Dent

EL SALVADOR

Ministry of Education

Dr. Walter Benecke

Ministry of Labor

Dr. Carlos Rivas
(Manpower Section)

Ministry of Health

Dr. Diza Nuna
Director General

Ministry of Agriculture

Ing. Lino Osequeda

UNESCO

Bruno Stiglitz

CONAPLANO

Roman Mayorga
(Ing. Suarez)

CENAFE (Centrode Exportación)

Robert P. Hoffman
Consultant

Instituto Technologico Centroamericano

Dennis F. Martin
Director

Society of Professional Engineers

Roberto Palomo
President

Ricardo Flores Ana

Chamber of Construction

Ing. Leon Cuellar
President

Instituto Salvadoreño del Seguro Social (ISSS)

José Kuri Asprides
Director General

Ricardo A. Novoa Arciniegas
Subdirector General

Instituto Technico Ricaldone (ITR)

Guiseppe Coro

Universidad Jose Simeon Canas

Luis Achaerandio, S. J.
Rector

Hospital Rosales

Dr. Armando Rivera Villaeorta
Director

Industrias Netalicas, S. A. (IMSA)

Ricardo Poma
Manager

Institutions Visited

Santa Tecla Agricultural Experimental Station
National Agricultural School, San Andres
Society of Architecture

Organization of Central American States (ODECA)

Lic. Alvaro Fernandez Escalante
Director of External Affairs

Prof. Eduardo Bolanos Santos
Director of Culture and Education

Dr. Juan A. Paredes
Director of Health

Organization of Central American States (ODECA)(Cont'd)

Lic. Louis Zúñega
Director of Labor

Lic. Hugo Gilberto Aleman
Assistant Director of Labor

U.S. Agency for International Development

Dr. Stanley Handleman
Dr. Albert Linstad
Dr. Glenn Holm
Mr. Herson Morales

GUATEMALA

Ministry of Agriculture

Dr. Carlos Anleu
(Agricultural Extension)

Ministry of Public Health

Dr. Romeo de Leon
Dr. Dairo de Leon
Dr. Santizo

Ministry of Education

Lic. Adrian Ramirez Flores
Division of Secondary Education

Ministry of Communication and Public Works

Lic. Edgardo Castaneda
Director, Middle Level Educational Projects

Instituto Centroamericano de Investigación de Technología Industrial (ICAITI)

Stefan Wittkowski
Director

Luis Vettorazzi

(FUCAP)

Lic. Arturo Debar
President

Ing. Jorge A. Serrano
Secretary General

Consejo Superior Universitario Centroamericano (CSUCA)

Dr. Donald Laurin
Dean, School of Sanitary Engineering

Dr. Theodore Elliot
Field Coordinator, School of Veterinary Medicine

National Economic Planning Council

Dr. Arquero Federico Fahsen

Del Valle University

Dr. Herman Aramburd
School of Public Health

Dr. Odette Alarcon

University of San Carlos

Ing. Mauricio Castillo
Dean of Engineering

Ing. Hugo Quan
Lic. Ricardo Pefia
Ing. Enrique Godoys

Food and Agricultural Organization (FAO)

Ing. Franz Billeb

Community Development

Dr. Salvador Hernandez

University of Landivar

Lic. Arturo Debar
Rector

Lic. Magda Barra Rivera
Assistant Dean

Technical Vocation Institute

Jose Candido Luna
Cesar Coronado
Francisco H. Perez

Secretaria Permanente del Tratado General de Integracion Economica Centroamericana (SEICA)

Julian Haro E.

Agricultural School at Barcenas

Mr. Kermit Adams

Other Institutions Visited

Roosevelt Hospital
University Mareano Galvas
Instituto Mercardo Tecnico (CENDAP)

AID-ROCAP

Alfred John Ravelli
Chief, Division of Human Resources

AID-ROCAP (Cont'd)

Frank Traiber
Norman McLennon
George V. Fortune
Peter Wright
Miss Burski

HONDURAS

Ministry of Education

Lic. Argentina Deras
Planeamiento Educación

Ministry of Labor

Lic. Arnaldo Villanueva

Ministry of Natural Resources

Lic. Tulio R. Giron

College of Economics

J. Leonardo Godoy

Asociacion Nacional de Industriales (ANDI)

Lic. Trinidad Fiallos

Consejo Superior de Planificacion Económica

Lic. Albeliza de Bonilla
Lic. Conrado Osorio E.

Honduras Council of Private Enterprise (COHEP)

Alfredo Pineira
Cap. Armando San Martin

Centro Cooperativo Técnico Industrial

Lic. Ernesto Baron Lupiac
Lic. Dorcas de González

Education Vocacional

Prof. Herminio Fajardo
Director

Financiera Hondurena

Lic. Mario Rietti M.

Universidad Nacional Autonoma de Honduras (UNAH)

Lic. Hernan Rodriquez Guerrero
Chief, Economic and Social Studies Section

Pan American School of Agriculture (at Zamarano)

Mr. Robert P. Armour
Director

Banco Nacional de Fomento

Hugo E. Rodriquez
Ing. Humberto León
Division of Industrial Development

U.S. Agency for International Development (AID)

Walter Stoneman
Director

Ray San Giovanni
Education Officer

Lic. Dorcas de Gozalez
Host Advisor

NICARAGUA

Ministry of Education

J. Antonio Mora R.
Minister

Professor Raúl Quintanilla
Director, Planning Office

Dr. Gerald Hamrin
Planning Office

Ministry of Economics, Industry and Commerce

Lic. Juan José Martinez L.
Minister

Dr. Luis Mejiá González
Coordinator of International Organizations

Ministry of Labor

Dr. Amilcar Ybarra Rojas
Minister

Dr. Alfredo Ferreti Lugo
Chief, General Inspection

Ministry of Agriculture and Animal Husbandry

Dr. Alfonso Lovo Cordero
Minister

Ing. Claudio Perez
Supervisor, Agricultural Extension Service

Ministry of Public Health

Dr. Francisco Urcuyo Maliano
Minister

Dr. Carlos H. Canales
Director

Institute of Social Security (INSS)

Lic. Ernesto Navarro Richardson
Director

Dr. Abraham Rossman
Medical Director

Institute for Nicaraguan Development (INDE)

José Alvarez Medrano
President

Lic. José Antonio Cerna
Executive Secretary

Lic. Gustavo Gutierrez
Director, EDUCREDITO

Ruth Kelly
Coordinator of Community Development Programs

Centralamerican Institute of Business Administration (INCAE)

Dr. Ernesto Cruz
Rector

Polytechnic Institute of Nicaragua (POLI)

Norberto Herrera
Director

Lic. David McField R.
Secretary General

University of Central America (UCA)

Padre León Pallais
Rector

Dr. Oscar Vannini
Dean of Engineering

Dr. Emilio Rappaccioli
Vice Dean of Engineering

National University (UNAN)

Dr. Carlos Tunnerman B.
Rector

Ing. Manuel Amaya Leclair
Dean of Physical Sciences-Mathematics

National Institute of Apprentice Training (INA)

Ing. Modesto Baltodano
Sub Director

National School of Agriculture (ENAG)

Ing. Noel Somarriba Barreto
Director

Central Bank of Nicaragua

Ing. Salvador Lopez Solorzano
Executive Secretary, Coordination Committee
for International Assistance

Ing. Fernando Sequeira
Director, Department of Technical Studies

Chamber of Commerce, Industry and Construction

Edgar J. Sevilla R.
Lic. César Abella

National Chamber of Commerce

Lic. Cesar Abella
Director

Chamber of Industries

Dr. Robert Solórzano Marín
Executive Secretary

Sr. Statthagen
Director, Productivity Center

Chamber of Construction

Ing. Nestor Pereira
Executive Secretary

U.S. Agency for International Development

Dr. Peter E. Tobia
Division of Human Resources

Albert Grego
Health Consultant

William Flexner
Family Planning Consultant

Carl M. Forsberg
Chief Engineer

Allen Goldstein
Chief, Program Office

American Embassy

Marilyn McAfee
Cultural Attaché

APPENDIX K

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FIELD TEAM–BIOGRAPHICAL INFORMATION

Harold P. Skamser
Dean of Engineering
California State Polytechnic College
Pomona, California

A letter from Skamser to John A. Hannah, Administrator of AID, not only prompted that agency to ask ASEE to conduct this study but also brought him to the attention of Society officials as a competent and interested prospect to serve as chief of the field party. He has had an abiding interest in Latin America, evidenced by many educational and civic involvements in southern California.

Dean Skamser holds an M.S. degree from the University of Minnesota and a B.S. in Electrical Engineering from Michigan State. His first degree in mathematics, earned at Wisconsin State College in 1931, prepared him for his first career as a teacher of mathematics and science in the public schools of Minnesota, Wisconsin and Illinois. He moved up to Michigan State University as a Professor of Mechanical Engineering after a summer appointment as an Assistant Professor at VPI in 1942. This sojourn at Michigan State was punctuated with tours of service in industry as a machine designer and engineering personnel specialist. He worked for National Iron Company, Reo Motors, Boeing Aircraft Company and Douglas Aircraft. Dean Skamser left Michigan State for Cal Poly, Pomona, in 1958 to serve as Dean of Engineering. In the fall of 1970 he relinquished this administrative burden to return to full-time teaching.

Dean Skamser has been active in the affairs of ASEE, serving as chairman of a committee in 1963 and as secretary of the Council for Sections West from 1963 through 1965. He is a member of the American Association of University Professors.

Born in Superior, Wisconsin, on April 6, 1909, Dean Skamser married Charlotte Ann Boggs in 1935. They have a son, Harold P. Jr., and a daughter, Susan. The Skamsers live at 19127 Swanee Lane, Covina, California 91722.

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Rudger H. Walker
Chairman, Department of
Agronomy and Horticulture
Brigham Young University
Provo, Utah

A major contribution to this study by Dr. Bruce Anderson of the Advisory Board was his recommendation of the appointment of Professor Walker to the Field Team. In his long and distinguished career as a practical and academic agronomist, Rudger Walker has circled the globe twice, visiting 20 foreign countries, including Guatemala and Honduras, on study assignments. He has published over 50 scientific and technical research papers, many in experiment station bulletins which describe improved soil use and conservation practices in agriculture and animal husbandry.

Born at Rexburg, Idaho, August 20, 1902, Walker earned a B.S. in Agronomy at Brigham Young University in 1923. A Ph.D. from Iowa State University in soil science preceded a multifaceted career as educator, public servant and administrator. While serving as a professor at Colorado State University (1927-1928) and at Iowa State University (1928-1936), he also put in a summer as a soil conservationist for the U.S. Department of Agriculture and served as a project leader on range reseeding at the Intermountain Forest and Range Experiment Station of the U.S. Forest Service located at Ogden, Utah.

Appointed in 1938, Walker served as dean of the school of agriculture and director of the agricultural experiment station and their successor organizations for 30 years. In 1968, he retired as dean to take up his present post. During his long service as dean, he received many special appointments, noteworthy among which were:

Director, U.S. Salinity Laboratory, U.S.D.A., Riverside, California
Chairman, Mission to Siam for the United Nations Food and Agriculture Organization
Special Agricultural Advisor to United Fruit Company in Central America
Assistant Director, Foreign Agriculture Service, U.S.D.A.
Director, Utah State University Contract Program with the College of Agriculture and Ministry of Agriculture in Iran under International Cooperation Administration auspices
Supervisor, Utah State University Contract Program in Tehran
Member, Board of Trustees, American University of Beirut

Walker's professional and civic appointments, honors and awards, and professional and agricultural society affiliations are too numerous to list.

He married Fawn L. Davies of Provo, Utah, in 1923. They have three sons and two daughters. The Walkers live at 1457 North Cherry Lane, Provo, Utah 84601.

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S. A. Billon
Professor of Business Administration
College of Business and Economics
University of Delaware
Newark, Delaware

Dr. Billon, showing commendable entrepreneurship as befits one of his business orientation, volunteered for the post on the Field Team after hearing of ASEE's plans through the academic grapevine. This was most fortuitous since he brought to the study a facility in Spanish and knowledge of Latin American customs acquired in the course of previous assignments in Brazil and Chile. From June 1961 through September 1965 he served as a visiting professor and advisor in the School of Administration of the University of Bahia, Brazil. Subsequently, in the summer and fall of 1967, he did a study of the national industrial development program of Chile for the U.S. Agency for International Development.

Dr. Billon's scholarly career began with a B.A. degree and, then, an M.B.A. degree from the University of Michigan. Switching to Michigan State University, he earned the Ph.D. in industrial management in 1959. His publications all pertain both to that subject and to economic development.

Dr. Billon's career has been salted with a number of mind-stretching assignments in industry. He has served as an engineering analyst for General Motors and the Automotive Parts Manufacturing Company. He was a field sales manager and training consultant to the P. F. Collier Corporation. Most recently, he has developed a comprehensive marketing program for the Shenandoah Gas Company.

Dr. Billon's earlier career included a tour as instructor in business management at Michigan State University and, from 1961 through 1968 he was a course director in the School of Logistics of the College of Commerce of Ohio State University.

The Billons have six children and live at 401 Old Oak Road, Newark, Delaware 19711.

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Robert E. McCord
Assistant Dean
College of Engineering
The Pennsylvania State University
University Park, Pennsylvania

Finding an engineering educator for the Field Team presented the ASEE Advisory Board with a problem of selection rather than of identifying qualified candidates. By juggling his personal arrangements, Dean McCord was able to accept the invitation to join the team.

Dean McCord's career at Penn State dates from 1948. Previously he had served the Navy in engineering and command functions and had put in a stint at Pratt & Whitney Aircraft as a senior analyst.

Dean McCord's career in engineering education has been closely tied to engineering technology. His ASEE and other professional association activities have been mainly concerned with the development of engineering technology education. Both his B.S. degree from Penn State and his M.S. degree from the Sloan School of Industrial Management of MIT are in industrial engineering and engineering management. He subsequently completed more graduate work at Purdue University and the University of California.

Pertinent to his role in this project was a six-month period in 1955 when he was consultant and head of the Department of Industrial Engineering at the University of Puerto Rico. This provided him with some insights into the needs for technical education in a Latin country with most of its industrial development still ahead of it.

In 1959, Professor McCord was appointed director of continuing education in the College of Engineering, and Assistant Dean for continuing education on April 1, 1965. He has responsibility for the expanding engineering programs in the Continuing Education Services which include evening technical institutes, in-plant training, management training, professional engineering review courses, and correspondence courses, as well as seminars, institutes and conferences in the field of engineering.

In 1964, he had an eight-week study grant from the English Speaking Union Technical Teachers Exchange Program to study programs in England related to Engineering Continuing Education and Technical Institute Education. He has served as consultant to the U.S. Department of Health, Education, and Welfare, to Kent State University on engineering technology, and to Georgia Institute of Technology on continuing education administration.

The McCords have three children and live at 449 Glenn Road, State College, Pennsylvania 16801.

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Robert L. Love
Chairman, Division of Health Technologies
State University Agricultural and Technical College
Alfred, New York

A happy combination of circumstances brought Professor Love to the ASEE Field Team. Dr. Jesse Defore of the ASEE headquarters staff recalled the continuing interest and support of health programs in Latin America by the W. K. Kellogg Foundation and suggested that Dr. Robert E. Kinsinger, the director of these programs for the Foundation, could recommend likely educators in health technology for the Field Team. Fortunately, Bob Love, his number one candidate, was able to revamp his schedule for the summer of 1970 to join the team.

Love brought to the team a deep immersion in health technology education. Putting an M.S. degree in education on top of a B.S. in zoology, both from Syracuse University, beginning in 1953 Professor Love went on to a succession of responsible posts at the Agricultural and Technical College of the State University of New York at Alfred, New York, culminating in his present assignment as chairman of the Division of Health Technologies.

Meanwhile, Professor Love has been called upon by numerous state and national organizations to aid in shaping education in the health technologies. In particular, he has served as chairman of the council on associate degree and certificate programs of the Association of Schools of Allied Health Professions and been active in the education committee of the American Society of Medical Technologists.

While administering health technology programs commanded most of his time, he still was able to study radiation biology at Cornell University in 1963-1964 and, earlier, to do research on proteins at Roswell Park Memorial Institute during the summers from 1961 to 1964.

He has authored many texts, monographs, and popular and scholarly journal articles on health technology education. As with the other members of this team, his honors are too numerous to list.

Bob is married to Janet Fuller, has three sons and a daughter and lives on rural delivery route one (RD No. 1), Alfred Station, New York 14803.

APPENDIX L

THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Aims and Objectives

The American Society for Engineering Education is committed to the continuous advancement and constant improvement of all aspects of higher and continuing education which pertain to the teaching and training of professional engineers and engineering technicians.

It serves its members, both individual and institutional, by:

- Giving direct aid to the development of more effective teaching faculty and engineering college administrators
- Producing advanced methods, techniques, and processes for improved instruction and training
- Producing advanced instructional materials and content as a basis for changing engineering curricula and initiating new programs to meet ever-changing conditions
- Enhancing professional ethics and standards
- Improving the content, administration, and support of engineering college research as an integral part of the educational process
- Coordinating institutional aims and programs, both among schools and colleges and in their joint relationships with professional, educational, and public bodies.

Individual Membership

Individuals who are, or who have been, actively engaged in any phase of the education of the engineer or technician, including faculty, engineering and research administrators, college and university administrators and students, and industrial and government personnel concerned with education of engineers and engineering technicians, are eligible for membership in ASEE.

Applications for individual membership should have the endorsement of two members of the Society and are submitted to the Board of Directors for election. Each member may join three of the 27 Society divisions as part of his membership. There is no initiation fee.

Structure

The Society is composed of individual and institutional members.

Interests of individual members are coordinated under four Councils–the Council of Technical Divisions and Committees and the Council of General Divisions and Committees, which are professional in nature; and the Councils of Sections East and of Sections West, which are geographical in nature.

Activities of institutional members are coordinated through the Engineering College Administrative Council (ECAC), the Engineering College Research Council (ECRC), and the Technical Institute Administrative Council (TIAC). Activities of industrial members are coordinated through the Relations with Industry Division.

Headquarters

ASEE is headquartered in Washington, D.C. This location in the National Capital enables the Society to keep in direct contact with federal agencies and national organizations which are interested and active in engineering education matters.

Projects

As a measure of the leadership ASEE has been assuming in recent years, the Society has administered or co-sponsored over 30 research and study projects. With financing from government, industry, and foundations, these have been completed in the seven years from 1963 through 1969. Current projects include fellowship programs, summer faculty institutes, faculty residencies in engineering practice, a two-year in-depth study of engineering technology education, faculty exchange and visiting faculty programs, a deans' institute, a study of the role of humanities and social sciences in the education of the engineer, a study of the application of technology to education, conferences on university-industry cooperation in engineering research and on humanizing education through technology, and this study.

The Society's involvement in these projects is controlled by the Projects Board and administered by a Director of Projects and Federal Relations and three project managers on the permanent headquarters staff.

Members of the Society are involved through participation on committees appointed to monitor projects and through submission of proposals for new projects. Activities approved by the Projects Board are expected to be national in scope and to deal with improvement of engineering education.

Publications

The official Society journal is *Engineering Education*, published eight times during the academic year. Every member receives the journal as a member service. Each month, *Engineering Education* highlights a topic of current interest, such as environmental design, systems engineering, laboratory instruction, and information processes.

Major reports, such as the *Final Report: Goals of Engineering Education* and *Liberal Learning for the Engineer*, are published separately as well as in *Engineering Education*. ECAC and ECRC jointly publish an annual *Directory of Engineering College Research and Graduate Study*, which details the research conducted by member institutions as well as information on graduate programs. ECRC has recently published a series of workshop reports on research administration.

Most divisions distribute newsletters and five have journals which are available on a subscription basis: *Chemical Engineering Education*, *Engineering Economist*, *Educational Research and Methods*, *Engineering Design Graphics Journal*, and *Mechanical Engineering News*.

The Society also publishes a series on continuing education and another on college-industry relations reporting the annual national College-Industry Conference of ASEE Relations with Industry Division. In addition, there is a series on mechanics. Booklets are available on teaching methods and guidance.

Awards

Each year the Society recognizes outstanding performance in teaching and in research by presenting awards. These awards honor engineering educators and researchers, outstanding contributors to technical institute education, teachers who demonstrate excellence in teaching, and authors of highly significant writings in the field of technical institute education. Also, seven divisions recognize excellence in their respective fields with awards.

The ASEE Board of Directors is the governing administrative body which coordinates the activities of the entire Society. Chairmen of the Councils are elected by the membership and are Vice Presidents of the Society. The Board of Directors is composed of the Society President, President Elect, Past President, Treasurer, the Council Vice Presidents, and the Executive Director. Special studies and projects to improve engineering education are approved by a Projects Board elected by the ASEE Board of Directors, and its Chairman is one of the Vice Presidents of the Society.

The Executive Director heads the national office staff and is charged with the continuing responsibility of carrying out the policies and decisions of the Board of Directors.

Divisions and Sections

In addition to the Councils, ASEE has 27 divisions and a number of committees representing professional branches of science, engineering, and related fields such as continuing and cooperative education, educational research and methods, and liberal studies. The divisions, committees, and institutional councils plan the professional sessions for the ASEE Annual Conference and are responsible for much of the technical work of the Society. Several divisions hold national meetings at other times.

The Society is geographically divided into 12 sections. Each member automatically becomes a member of the section in which he resides. These sections hold meetings once or twice a year and cooperate in regional effective teaching institutes sponsored by the Society.

Divisions and Committees

Divisions

- Aerospace
- Agricultural Engineering
- Architectural Engineering
- Chemical Engineering
- Civil Engineering (Construction, Hydraulics, Sanitary, Soil Mechanics, Structural, Surveying, Transporation)
- Continuing Engineering Studies
- Cooperative Education
- Educational Research & Methods
- Electrical Engineering
- Engineering Economy
- Engineering Design Graphics
- Graduate Studies
- Industrial Engineering
- Liberal Studies (Economics, English, History, Languages, Psychology)
- Materials
- Mathematics
- Mechanical Engineering (Machine Design, Manufacturing Processes, Thermodynamics and Power)
- Mechanics
- Mineral Engineering (Geology, Mining, Petroleum, Metals, Ceramics)
- Nuclear Engineering
- Physics
- Relations With Industry
- Technical Institute
- Environmental Engineering
- Instrumentation
- Engineering School Libraries
- International

Committees

- Biomedical Engineering
- Ethics and Legal Phases
- Ocean Engineering
- Textile Engineering
- Energy Conversion

APPENDIX M

Sample Diplomas and Titles for Graduates of the Instituto Politechnico de Nicaragua

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EL INSTITUTO POLITECNICO DE NICARAGUA

POR CUANTO:

Audelia Solís Morales Natural de **Juigalpa** Departamento de **Chontales** República de Nicaragua, ha cumplido todos los requisitos exigidos por la Escuela de **Dibujo Comercial y Publicitario** así como las disposiciones pertinentes establecidas por el Instituto Politecnico de Nicaragua, segun consta en Acta del veinticinco de febrero de mil novecientos setenta.

POR TANTO:

Se le extiende este Diploma de **Dibujante Comercial y Publicitario** para que goce de las prerrogativas que la ley concede.

Dado en la ciudad de Managua, Distrito Nacional, a los veintisiete días de febrero de mil novecientos setenta.

El Director de la Escuela

El Director General del Politecnico

El Interesado

Registrado al folio ____ del Libro respectivo

Managua, D. N. ____

Secretario General del Politecnico

REPUBLICA DE NICARAGUA　　AMERICA CENTRAL

EL PRESIDENTE DE LA REPUBLICA

POR CUANTO:

Andelia Solís Morales Natural de **Juigalpa** Departamento de **Chontales** República de Nicaragua, ostenta el Diploma de **Dibujante Comercial y Publicitario** otorgado por el Instituto Politécnico de Nicaragua, en la ciudad de Managua, a los veintisiete días del mes de febrero de mil novecientos setenta y se ha dictado el acuerdo del ____ ____ ordenando que se le extienda el Título correspondiente.

POR TANTO:

Se le extiende el presente Título de **Dibujante Comercial y Publicitario** firmado de su mano, sellado con el gran sello de la Nación y refrendado por el Señor Ministro de Educación Pública y por el Director General del Instituto Politécnico de Nicaragua, para que goce de todos los derechos y prerrogativas que le conceden las leyes de la República.

Dado en la ciudad de Managua, D. N. a los ____ días del mes de ____ de mil novecientos setenta

El Presidente de la República

El Ministro de Educación Pública

El Director General del Politecnico

Registrado al folio ____ Partida ____ del Libro respectivo.

Managua, D. N. ____

Director de Servicios Administrativos

El Interesado

Registrado al folio ____ del Libro respectivo

Managua, D. N. ____

Secretario General del Politecnico

APPENDIX N

A 1968 Proposal (Academic Plan) by the University of San Carlos in Guatemala City for implementation in 1974.

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SUB-PROGRAMA A-7-3: FORMACION DE PROFESORES DE EDUCACION MEDIA Y DE TECNICOS UNIVERSITARIOS DE NIVEL INTERMEDIO

1. OBJETIVO

La formación de profesores de educación media tiene por objeto satisfacer parcialmente la necesidad nacional de los mismos e incidir favorablemente sobre la formación pre-ùniversitaria. La formación de tecnicos universitarios de nivel intermedio tiene por objeto suministrar el personal de colaboración y apoyo a las labores de los profesionales.

2. METAS DE GRADUACION 1974

Profesores de Educación Media: 1,700

Técnicos Universitarios de Nivel Intermedio : 1,000

3. TIEMPO

Etapa de preparación y formación:
36 meses

Etapa de graduación:
Diciembre 1971 en adelante

4. PROYECTOS O ACTIVIDADES DEL SUB-PROGRAMA

1. Creación del Instituto de Formación de Profesores de Segunda Enseñanza; (Estructura docente, administrativa, legal y financiera);
2. Creación del sistema de formación de Técnicos Universitarios de Nivel Intermedio; (Estructura docente, administrativa, legal y financiera);
   - Area de Ciencias de la Salud +
   - Area Científico-Tecnológica ++
   - Area de Ciencias Sociales y Humanidades +++

5. OTROS SUB-PROGRAMAS NECESARIOS A ESTE SUB-PROGRAMA

1. Planificación de la Planta Física;
2. Centro de Promoción y Orientación de Becas;
3. Aumento de la Matrícula Total y por Areas.

TECNICOS UNIVERSITARIOS DE NIVEL INTERMEDIO*

1. AREA DE CIENCIAS DE LA SALUD +

CIENCIAS MEDICAS	Enfermeras Auxiliares de Enfermeras Inspectores Sanitarios Tecnólogos Médicos: Rayos X, Fisioterapistas, etc. Comadronas Dietista Optometrista
ODONTOLOGIA	Técnicos de Laboratorio Dental Asistentes Dentales Higienistas Dentales

2. AREA CIENTIFICO-TECNOLOGICA ++

INGENIERIA	Sobrestante de Obra Auxiliar de Topografía y Cartografía Dibujante Técnico de Ingeniería Técnicos Auxiliares de Ingeniería Operadores de Plantas de Agua Hidrólogo
ARQUITECTURA	Administrador de Obras Dibujante Técnico de Arquitectura Técnicos Auxiliares de Arquitectura
AGRONOMIA Y MEDICINA VETERINARIA Y ZOOTECNIA	Administrador de Empresas Agrícolas Tecnólogo Auxiliar Agrícola Técnico en Producción Vegetal Técnico en Producción Forestal Técnico en Mecánica Agrícola Técnico en Ganadería

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*Los nombres de los Tecnicos Universitarios de Nivel Intermedio que se enuncian son indicativos de posibles carreras intermedias. Las Areas de Docencia y sus Facultades respectivas reglamentaran el tiempo de duracion, el contenido y el nivel en cada caso, de las carreras cortas que se impartan.

3. AREA DE CIENCIAS SOCIALES Y HUMANIDADES	+++
CIENCIAS ECONOMICAS	Auxiliar de Estadísticos Demógrafos Contadores Industriales Aduaneros Técnicos Cooperativistas
CIENCIAS JURIDICAS Y SOCIALES	Procurador Trabajadores Sociales Promotores Sociales
HUMANIDADES	Bibliotecario Auxiliar Corrector de Pruebas Supervisor Escolar
4. AREA DE CIENCIAS	Auxiliar de Laboratorio
FARMACIA QUIMICA BIOLOGIA FISICA MATEMATICAS	